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R. M. BALLANTYNE

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UP IN THE CLOUDS

OR

BALLOON VOYAGES

By R. M. BALLANTYNE,

AUTHOR OF "THE LIFEBOAT;" "THE LIGHTHOUSE;" "THE IRON HORSE;" "UNDER THE WAVES;" "RIVERS OF ICE;" "SHIFTING WINDS," ETC. ETC.

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NOTE

PLAN OF THIS MISCELLANY

THERE is a vast amount of interesting information on almost all subjects, which many people, especially the young, cannot attain to because of the expense, and, in some instances, the rarity of the books in which it is contained.

To place some of this information, in an attractive form, within the reach of those who cannot afford to purchase expensive books, is the principal object of this miscellany.

Truth is stranger than fiction, but fiction is a valuable assistant in the development of truth. Both, therefore, shall be used in these volumes. Care will be taken to ensure, as far as is possible, that the *facts* stated shall be true, and that the *impressions* given shall be truthful.

As all classes, in every age, have proved that tales and stories are the most popular style of literature, each volume of the series (with, perhaps, one or two exceptions) will contain a complete tale, the heroes and actors in which, together with the combination of circumstances in which they move, shall be more or less fictitious.

In writing these volumes, the author has earnestly endeavoured to keep in view the glory of God and the good of man.

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UP IN THE CLOUDS

OR

BALLOON VOYAGES

CHAPTER I

TREATS OF EARLY EFFORTS TO FLY, ETC.

IT is man's nature to soar intellectually, and it seems to have been his ambition from earliest ages to soar physically.

Every one in health knows, or at some period of life must have known, that upward bounding of the spirit which induces a longing for the possession of wings, that the material body might be wafted upwards into those blue realms of light, which are so attractive to the eye and imagination of poor creeping man that he has appropriately styled them the heavens.

Man has envied the birds since the world began. Who has not watched, with something more than admiration, the easy gyrations of the sea-mew, and listened, with something more than delight, to the song of the soaring lark?

To fly with the body as well as with the mind, is a wish so universal that the benignant Creator Himself seems to recognise it in that most attractive passage in Holy Writ, wherein it is said that believers shall "mount up with wings as eagles, they shall run and not be weary, they shall walk and not faint."

Of course man has not reached the middle of the nineteenth century without making numerous attempts to fly bodily up to the skies. Fortunately, however, such ambitious efforts have seldom been made except by the intellectually enthusiastic. Prosaic man, except in the case of the Tower of Babel, has remained content to gaze upwards with longing desire, and only a few of our species in the course of centuries have possessed temerity enough to make the deliberate effort to ride upon the wings of the wind.

Naturally, the first attempts were, like most beginnings, simple and imitative. The birds flew with wings, therefore man put on artificial wings and essayed to fly like the birds. It was not until many grievous disappointments and sad accidents had befallen him that he unwillingly gave up wings in despair, and set to work to accomplish his ends by more cumbrous and complex machinery.

Very early in the world's history, however, "flying machines" were made, some of which were doubtless intended by their honest inventors to carry men through the air, while others were mere

shams, made by designing men, wherewith to impose upon the ignorant for wicked ends of their own; and some of these last were, no doubt, believed to be capable of the feats attributed to them.

The credulity of the ancients is not to be wondered at when we reflect on the magical illusions which science enables us to produce at the present day—illusions so vivid and startling that it requires the most elaborate explanations by adepts and philosophers to convince some among their audiences that what they think they see is absolutely not real! No wonder that the men of old had firm faith in the existence of all kinds of flying machines and creatures.

They believed that fiery dragons were created by infernal machination, which, although not what we may call natural creatures, were nevertheless supposed to rush impetuous through the sky, vomiting flames and scattering the seeds of pestilence far and wide. In those dark ages, writers even ventured to describe the method of imitating the composition of such terrific monsters! A number of large hollow reeds were to be bound together, then sheathed completely in skin, and smeared over with pitch and other inflammable matters. This light and bulky engine, when set on fire, launched during thick darkness from some cliff into the air, and borne along by the force of the wind, would undoubtedly carry conviction to

the minds of the populace, whilst it would fill them with amazement and terror!

Sometimes, however, those who attempted to practise on the credulity of their fellows were themselves appalled by the results of their contrivances. Such was the case so late as the year 1750, when a small Roman Catholic town in Swabia was almost entirely burnt to ashes by an unsuccessful experiment made by some of the lowest order of priests for the astonishment, if not the edification, of their flocks. An attempt was made by them to represent the effigy of Martin Luther, whom the monks believed to be in league with Satan, under the form of a winged serpent with a forked tail and hideous claws. Unfortunately Martin's effigy, when ignited, refused to fly, and, instead of doing what was required of it, fell against the chimney of a house to which it set fire. The flames spread furiously in every direction, and were not subdued until the town was nearly consumed.

In the early part of the sixteenth century a very determined attempt at flying was made by an Italian who visited Scotland, and was patronised by James IV. He gained the favour of that monarch by holding out to him hopes of replenishing his treasury by means of the "philosopher's stone." The wily Italian managed, by his plausible address, to obtain a position which replenished, to some degree, his own empty purse, having been collated by royal favour to the abbacy of Tungland, in

Galloway. Being an ingenious fellow, and somewhat, apparently, of an enthusiast, he spent some of his leisure time in fashioning a pair of huge wings of various plumage, with which he actually undertook to fly through the air from the walls of Stirling Castle to France! That he believed himself to be capable of doing so seems probable, from the fact that he actually made the attempt, but fell to the ground with such violence as to break his leg. He was sharp-witted, however, for instead of retiring crest-fallen at his failure, he coolly accounted for the accident by saying, "My wings were composed of various feathers; among them were the feathers of dunghill fowls, and they, by a certain sympathy, were attracted to the dunghill; whereas, had my wings been composed of eagles' feathers alone, the same sympathy would have attracted them to the region of the air!"

About a century later a poor monk, whose boldness and enterprise were more conspicuous than his prudence, attempted a similar feat. He provided himself with a gigantic pair of wings, constructed on a principle propounded by the rector of the grammar school of Tübingen, in 1617, and, leaping from the top of a high tower, fell to the ground, broke both his legs, and lost his life.

It was long before men came to see and admit that in regard to this they were attempting to accomplish the impossible.

There can be no doubt that it is absolutely im-

possible for man to fly by the simple power of his own muscles, applied to any sort of machinery whatever. This is not an open question. That man may yet contrive to raise himself in the air by means of steam or electricity, or some other motive power, remains to be seen. It does not seem probable, but no one can say authoritatively that it is impossible. It is demonstrable, however, that to rise, or even to remain suspended, in the air by means of machinery impelled by human force alone is a feat which is as much an impossibility as it is for a man, by the strength of his own legs, to leap thirty or forty times his own length,—a grasshopper can do that easily, and a bird can fly easily, but a man cannot, and never will be able to do so, because his peculiar conformation forbids it.

This was first demonstrated by Borelli, an eminent Italian mathematician and philosopher, who lived in a fertile age of discovery, and was thoroughly acquainted with the true principles of mechanics and pneumatics. He showed, by accurate calculation, the prodigious force which in birds must be exerted and maintained by the pectoral muscles with which the all-wise Creator has supplied them, and, by applying the same principles to the structure of the human frame, he proved how extremely disproportionate was the strength of the corresponding muscles in man. In fact, the man who should attempt to fly like a bird would be guilty of greater folly and ignorant presumption

than the little infant who should endeavour to perform the feats of a gladiator! It is well for man in all things to attain, if possible, to a knowledge of what certainly lies beyond his powers, for such knowledge prevents the waste and misdirection of energies, as well as saving from disappointment and other evil results.

But many of those enthusiasts, who have attempted at various periods of the world's history to fly, did not fall into the error which we have attempted to point out. On the contrary, they went intelligently to work; their only aim being modestly to fly *somewhat* after the manner of a bird, but they all failed; nevertheless one philosopher, of modern times, stoutly continued to assert the opinion that there is no impossibility in man being able to fly *apparently*, though not really, like a bird. He did not hold that man could ever fly as high, or as far, or as fast, or in any degree as easily, as a bird. All that he ventured to say was, that he might perhaps fly *somewhat like one!*

As the plan of this philosopher is rather curious, we shall detail it.

It is well known that balloons, filled with appropriate gas, will rise. Big balloons and little ones are equally uppish in their tendencies. It is also known that rotundity of form is not essential to the successful rising of a balloon. "Well, then," says this philosopher, "what is to prevent a man making two balloons, flattish, and in the form of

wings, which, instead of flying away with him, as ordinary balloons would infallibly do, should be so proportioned to his size and weight as that they would not do more than raise him an inch or so off the ground, and so keep him stotting and bobbing lightly about, something like the bright thin india-rubber balls with which children are wont to play now-a-days?

"Having attained this position of, so to speak, readiness to fly, there is nothing to prevent him from propelling himself gently along the surface of the ground by means of fans, or, if you choose, small flexible cloth wings attached to the hands and arms. The legs might also be brought into play a little. It is obvious, however, that such wings would require to be mounted only in calm weather, for a breeze of wind would infallibly sweep the flyer off the face of the earth! We would only observe, in conclusion, that, however ridiculous this method of flying may appear in your eyes, this at least may be said in its favour, that whereas all other plans that have been tried have signally failed, *this* plan has never failed—never having been tried! We throw the idea before a discriminating public, in the hope that some aspiring enthusiast, with plenty of means and nerve, and no family to mourn his loss, may one day prove, to the confusion of the incredulous, that our plan is not a mere flight of imagination!"

When men began to find that wings refused in any

circumstances to waft them to the realms of ether, they set about inventing aërial machines in which to ascend through the clouds and navigate the skies.

In the fourteenth century a glimmering of the true principles on which a balloon could be constructed was entertained by Albert of Saxony, a monk of the order of St. Augustin, but he never carried his theories into practice. His opinion was that, since fire is more attenuated than air, and floats above the region of our atmosphere, all that was necessary would be to enclose a portion of such ethereal substance in a light hollow globe which would thus be raised to a certain height, and kept suspended in the sky, and that by introducing a portion of air into the globe it would be rendered heavier than before, and might thus be made to descend. This was in fact the statement of the principles on which fire balloons were afterwards constructed and successfully sent up, excepting that air heated by fire, instead of fire itself, was used.

Others who came after Albert of Saxony held the same theory, but they all failed to reduce it to practice, and most of these men coupled with their correct notions on the subject the very erroneous idea that by means of masts, sails, and a rudder, a balloon might be made to sail through the air as a ship sails upon the sea. In this they seem to have confounded two things which are dissimilar, namely, a vessel driven through water, and a vessel floating in air.

The fallacy here may be easily pointed out. A ship is driven through water by a body in motion, namely, wind, while its rudder is dragged through a body comparatively at rest, namely, water; hence the rudder slides against or is pushed against the water, and according as it is *turned* to one side or the other, it is *pushed* to one side or the other, the stern of the ship going along with it, and the bow, of course, making a corresponding motion in the opposite direction. Thus the ship is turned or "steered," but it is manifest that if the ship were at rest there would be no pushing of the rudder by the water—no steering. On the other hand, if, though the ship were in motion, the sea was also flowing at the *same rate* with the wind, there would be no flowing of water past the ship, the rudder would not be acted on, and the vessel could not be steered.

Now a balloon, carried by the wind, cannot be steered by a rudder, because it does not, like the ship, rest half in one medium which is in motion, and half in another medium which is at rest. There is no sliding of any substance past its side, no possibility therefore of pushing a rudder against anything. All floats along *with* the wind.

If, however, the balloon could be made to go *faster* than the wind, then steering would at once become possible; but sails cannot accomplish this, because, although wind can drive a ship faster than water flows, wind cannot drive a substance faster than itself flows.

The men of old did not, however, seem to take these points into consideration. It yet remains to be seen whether steam shall ever be successfully applied to aërial machines, but this may certainly be assumed in the meantime, that, until by some means a balloon is propelled *faster than the wind* through the atmosphere, sails will be useless, and steering, or giving direction, impossible.

It was believed, in those early times, when scientific knowledge was slender, that the dew which falls during the night is of celestial origin, shed by the stars, and drawn by the sun, in the heat of the day, back to its native skies. Many people even went the length of asserting that an egg, filled with the morning dew, would, as the day advanced, rise spontaneously into the air. Indeed one man, named Father Laurus, speaks of this as an observed fact, and gravely gives directions how it is to be accomplished. "Take," says he, "a goose's egg, and having filled it with dew gathered fresh in the morning, expose it to the sun during the hottest part of the day, and it will ascend and rest suspended for a few moments." Father Laurus must surely have omitted to add that a goose's brains in the head of the operator was an element essential to the success of the experiment!

But this man, although very ignorant in regard to the nature of the substances with which he wrought, had some quaint notions in his head. He thought, for instance, that if he were to cram the

cavity of an artificial dove with highly condensed air, the imprisoned fluid would impel the machine in the same manner as wind impels a sail. If this should not be found to act effectively, he proposed to apply fire to it in some way or other, and, to prevent the machine from being spirited away altogether by that volatile element, asbestos, or some incombustible material, was to be used as a lining. To feed and support this fire steadily, he suggested a compound of butter, salts, and orpiment, lodged in metallic tubes, which, he imagined, would at the same time heighten the whole effect by emitting a variety of musical tones like an organ!

Another man, still more sanguine than the last in his aërial flights of fancy, proposed that an ascent should be attempted by the application of fire as in a rocket to an aërial machine. We are not, however, told that this daring spirit ever ventured to try thus to invade the sky.

There can be no doubt that much ingenuity, as well as absurdity, has been displayed in the various suggestions that have been made from time to time, and occasionally carried into practice. One man went the length of describing a huge apparatus, consisting of very long tin pipes, in which air was to be compressed by the vehement action of fire below. In a boat suspended from the machine a man was to sit and direct the whole by the opening and shutting of valves.

Another scheme, more ingenious but not less

fallacious, was propounded in 1670 by Francis Lana, a Jesuit, for navigating the air. This plan was to make four copper balls of very large dimensions, yet so extremely thin that, after the air had been extracted, they should become, in a considerable degree, specifically lighter than the surrounding medium. Each of his copper balls was to be about 25 feet in diameter, with the thickness of only the 225th part of an inch, the metal weighing 365 pounds avoirdupois, while the weight of the air which it should contain would be about 670 pounds, leaving, after a vacuum had been formed, an excess of 305 pounds for the power of ascension. The four balls would therefore, it was thought, rise into the air with a combined force of 1220 pounds, which was deemed by Lana to be sufficient to transport a boat completely furnished with masts, sails, oars, and rudders, and carrying several passengers. The method by which the vacuum was to be obtained was by connecting each globe, fitted with a stopcock, to a tube of at least thirty-five feet long; the whole being filled with water; when raised to the vertical position the water would run out, the stopcocks would be closed at the proper time, and the vacuum secured. It does not seem to have entered the head of this philosopher that the weight of the surrounding atmosphere would crush and destroy his thin exhausted receivers, but he seems to have been alarmed at the idea of his supposed discovery being applied to improper uses, such as the passing of

desperadoes over fortified cities, on which they might rain down fire and destruction from the clouds!

Perhaps the grandest of all the fanciful ideas that have been promulgated on this subject was that of Galien, a Dominican friar, who proposed to collect the fine diffused air of the higher regions, where hail is formed, above the summit of the loftiest mountains, and to enclose it in a cubical bag of enormous dimensions—extending more than a mile every way! This vast machine was to be composed of the thickest and strongest sail-cloth, and was expected to be capable of transporting through the air a whole army with all their munitions of war!

There were many other devices which men hit upon, some of which embraced a certain modicum of truth mixed with a large proportion of fallacy. Ignorance, more or less complete, as to the principles and powers with which they dealt, was, in days gone by, the cause of many of the errors and absurdities into which men were led in their efforts to mount the atmosphere. Our space, however, forbids further consideration of this subject, which is undoubtedly one of considerable interest, and encircled with a good deal of romance.

Turning away from all those early and fanciful speculations, we now come to that period in the history of balloon voyaging, or aëronautics, when true theories began to be philosophically applied, and ascending into the skies became an accomplished fact.

CHAPTER II

THE FIRST BALLOONS

THE germ of the invention of the balloon lies in the discovery of Mr. Cavendish, made in 1766, that hydrogen gas, called inflammable air, is at least seven times lighter than atmospheric air. Founding on this fact, Dr. Black of Edinburgh proved by experiment that a very thin bag, filled with this gas, would rise to the ceiling of a room.

In Dr. Thomson's *History of Chemistry*, an anecdote, related by Mr. Benjamin Bell, refers to this as follows :—

"Soon after the appearance of Mr. Cavendish's paper on hydrogen gas, in which he made an approximation to the specific gravity of that body, showing that it was at least ten times lighter than common air, Dr. Black invited a party of friends to supper, informing them that he had a curiosity to show them. Dr. Hutton, Mr. Clerk of Eldin, and Sir George Clerk of Penicuik, were of the number. When the company invited had arrived, he took them into a room where he had the allantois of a calf filled with

hydrogen gas, and, upon setting it at liberty, it immediately ascended and adhered to the ceiling. The phenomenon was easily accounted for; it was taken for granted that a small black thread had been attached to the allantois, that the thread passed through the ceiling, and that some one in the apartment above, by pulling the thread, elevated it to the ceiling, and kept it in its position! This explanation was so plausible, that it was agreed to by the whole company, though, like many other plausible theories, it turned out wholly fallacious, for, when the allantois was brought down, no thread whatever was found attached to it. Dr. Black explained the cause of the ascent to his admiring friends; but such was his carelessness of his own reputation, that he never gave the least account of this curious experiment even to his class, and several years elapsed before this obvious property of hydrogen gas was applied to the elevation of balloons."

Cavallo made the first practical attempts with hydrogen gas six years later, but he only succeeded in causing soap-bubbles to ascend.

At last the art of aërial navigation was discovered in France, and in 1782 the first ascent was made. The triumph was achieved by Stephen and Joseph Montgolfier, sons of a wealthy paper-maker who dwelt at Annonay, on the banks of a rivulet which flows into the Rhone, not far from Lyons.

These brothers were remarkable men. Although

bred in a remote provincial town, and without the benefit of a liberal education, they were possessed in a high degree of ingenuity and the spirit of observation. They educated themselves, and acquired an unusually large stock of information, which their inventive and original minds led them to apply in new fields of speculation. They were associated in business with their father, a man who passed his quiet days like a patriarch amidst a large family and a numerous body of dependants, until he reached the advanced age of ninety-three.

Stephen devoted himself chiefly to the study of mathematics, Joseph to chemistry; and they were accustomed to form their plans in concert. It appears that they had long contemplated, with philosophical interest, the floating and ascent of clouds in the air, and when they heard of or read Cavendish's theories in regard to *different kinds of air*, it at once struck them that by enclosing some gas lighter than the atmosphere in a bag a weight might be raised from the earth into the air.

The brothers Montgolfier were men of that vigorous stamp who act promptly on receiving their convictions. At once they set about experimenting, and constructed large bags of paper,—the substance which naturally came readiest to their hands, and which appeared to them to be best suited to their purpose. These were filled with

hydrogen gas, which raised them to the ceiling; but, owing to the escape of the gas through the pores and cracks of the case, those embryo balloons descended in a few minutes. Instead of varnishing the paper to prevent the escape of the gas, and supposing, erroneously, that the fault lay in the latter, they sought about for a new gas more suitable to the paper. This they found, as they supposed, in the gas which resulted from the combustion of wet straw and wool, which had an upward tendency, they thought, on account of its electrical properties, which caused it to be repelled from the ground. It is scarcely necessary now to point out that the true cause of the upward tendency lay in the rarefaction of the air by the heat of the fire, and that hot air has a tendency to rise because its bulk is greatly increased beyond the same quantity of the surrounding cold air.

Although wrong in assigning the cause of the result, they were right in the application of it. While on a visit to Avignon Joseph Montgolfier procured a silk bag having a small opening at its lower end, and a capacity of about fifty cubic feet. Under the orifice some paper was burnt; the air inside was heated and expanded so as to fill the bag, which, when let go, soared rapidly up to the height of seventy or eighty feet, where it remained until the air cooled and allowed it to descend. Thus did the *first* balloon ascend in the month of November 1782.

Delighted with their success, the indefatigable brothers resolved to make further experiments on a larger scale. They procured a quantity of packcloth or coarse linen, formed it into a globe about ninety feet in circumference, lined it with paper, and lighted a fire under it in an iron choffer. This balloon went up with a force which they estimated as equivalent to 500 pounds.

After this the Montgolfiers appeared to have become ambitious of accomplishing greater things, and giving to their discoveries publicity; for we are told that "they invited the members of the provincial meeting of the states of the Vivarais, then assembled at Annonay, to witness the first *public* aërial ascent. On the 5th June 1783, amidst a very large concourse of spectators, the spherical bag or balloon, consisting of different pieces of linen, merely buttoned together, was suspended from cross poles. Two men kindled a fire under it, and kept feeding the flame with small bundles of chopped straw. The loose bag gradually swelled, assuming a graceful form, and in the space of five minutes it was completely distended, and made such an effort to escape that eight men were required to hold it down.

"On a signal being given the stays were slipped, and the balloon instantly rose with an accelerating motion till it reached some height, when its velocity continued uniform, and carried it to an elevation of more than a mile. All was admiration and trans-

port. Amidst the shouts of unbounded applause, the progress of the artificial cloud retiring from sight arrested every eye. It was hurried along by the wind; but its buoyant force being soon spent, it remained suspended only ten minutes, and fell gently in a vineyard at a distance of about a mile and a half from the place of its ascension. So memorable a feat lighted up the glow of national vanity, and the two Montgolfiers were hailed and exalted by the spontaneous impulse of their fellow-citizens."

This event created a sensation not only in France but over the whole of Europe. In Paris, particularly, the effect on all classes was so great that they determined to have the experiment repeated, set a subscription on foot, and appointed a scientific man named Charles, and two brothers of the name of Robert, to construct a balloon. This they did, but instead of applying the Montgolfier motive power—heated air—they used hydrogen gas, procured by the action of diluted sulphuric acid upon iron filings. Their balloon, which was made of thin silk, varnished with a solution of elastic gum, was a much nearer approach to the balloon of modern days than that of Montgolfier. It was a great success; rose and remained suspended at a height of 100 feet, in which state it was conveyed with acclamation to the Place des Victoires, where it rested and underwent some repairs. At midnight it was conveyed in solemn procession by torchlight,

and guarded by a detachment of horse, to the Champ de Mars, where, on the following day, the whole world of Paris turned out to witness another ascent. The balloon went up to the sound of cannon, and in two minutes reached a height of 3000 feet, when it was lost for a time in a dark cloud, but speedily reappeared still higher. After a flight of fifteen miles, performed in three quarters of an hour, it sunk to the ground in a field near Ecouen, where it was secured by the peasants.

The Parisians now appeared to become balloon-mad. The Royal Academy of Sciences invited Joseph Montgolfier to repeat his experiments, and another balloon was prepared by him of coarse linen with a paper lining, which, however, was destroyed by incessant and violent rain before it could be tried. Undeterred by this, another was constructed by him, which ascended from Versailles on the 19th of September 1783.

This balloon deserves peculiar notice as being the first which carried up living creatures. A sheep, a cock, and a duck, were the first aëronauts! They ascended to a height of about 1500 feet; remained suspended for a time, and descended some two miles off in perfect safety—indeed we may say in perfect comfort, for the sheep was discovered to be quietly feeding when it returned to the earth!

The practicability of ballooning being now fairly established, men soon began to venture their own persons in the frail cars. A young and enthusiastic

naturalist named Rozier leaped into the car of another of Montgolfier's balloons soon after this, and ascended in safety to an elevation of about 300 feet, but on this occasion the balloon was held down by ropes. The ice, however, was broken, and bolder attempts quickly followed.

CHAPTER III

EARLY ATTEMPTS AT AËRIAL NAVIGATION

THE first free and unfettered balloon voyage was performed very soon after the event mentioned at the end of the last chapter. It was a daring attempt, and attended with great danger.

A balloon made by Montgolfier was used. It was 75 feet high, 45 feet wide, and spheroidal in form—heated air being the motive power. The bold aëronauts, on this occasion, were the naturalist Rozier and the Marquis d'Arlandes, a major of infantry. From the gardens of the Chateau of Muetta they ascended on the 21st November 1783.

In the car there was a quantity of ballast, and a provision of straw to feed the fire. The balloon mounted at first with a majestic steady motion, gazed at in breathless wonder by thousands of spectators, who assembled not only in the neighbourhood of the Chateau, but clustered on every point of vantage in Paris.

When the daring voyagers reached a considerable height, they took off their hats and waved them to their friends below, and the multitude—realising,

perhaps, that that which in former ages had been deemed the dream of visionaries was at last an accomplished fact—responded with enthusiastic acclamations until the balloon passed upwards through the clouds and was lost to view.

It would seem that these first aëronauts were of different temperaments ; for, after they had reached a height of nearly 3000 feet, and the earth was no longer distinguishable, the Marquis began to think that he had seen enough of the upper regions, would fain have descended, and murmured against his companion, who still kept feeding the fire. Apparently his alarm was justifiable, for Rozier continued recklessly to heap on fuel, until he almost set the balloon on fire. On hearing some cracks from the top, and observing some holes burning in its sides, the Marquis became so alarmed that he compelled his companion to desist, and with wet sponges stopped the conflagration, which had actually begun.

When the fire diminished, however, the balloon began to descend much quicker than was safe or agreeable, and the marquis himself began to throw fresh straw on the fire to enable them to clear the roofs of Paris. This they did very dexterously, considering that they were so unaccustomed to such navigation, throwing on just as much fuel as was sufficient for the purpose, and keeping clear of steeples and chimneys until they alighted in safety beyond the Boulevards. Their voyage lasted about

half-an-hour, and they described a track of six miles around Paris, having ascended to a height of 3000 feet.

Thus was the first balloon voyage successfully accomplished by the French; and the Montgolfiers, besides enjoying the triumph which their persevering efforts deserved, were awarded the annual prize —six hundred livres—of the Academy of Sciences. The elder brother was invited to Court, decorated with the badge of St. Michael, and received a patent of nobility; while the younger received a pension and a sum of forty thousand livres wherewith to prosecute his experiments with balloons.

The great success of the Montgolfier balloons naturally threw the efforts of M. Charles and the brothers Robert into the shade. Nevertheless those gentlemen had got hold of a better principle than their rivals; and, knowing this, they resolved to convince the sceptical by constructing another balloon. They wisely began by obtaining subscriptions to enable them to carry out their designs, and finally succeeded in making a globe formed of tiffany, covered with elastic varnish, which was twenty-eight feet in diameter. This they filled with hydrogen gas. Some idea of their difficulties and expenses may be gathered from the fact that the mere filling of the balloon required an apparatus which cost about £400 sterling, one-half of which was expended on the production of the gas alone.

The ascent of this balloon deserves to be regarded

with special interest, because, besides being the first *hydrogen* balloon which carried up human beings, it was the first in which scientific observations were made and recorded. M. Charles was a lecturer on natural philosophy, and, like our own great aëronaut, Mr. Glaisher, does not seem to have been content to produce merely a spectacle, but went up to the realms of ether with an intelligent and scientific eye; for we read of him recording the indications of the thermometer and barometer at different heights and under various conditions.

There were many accidents and delays in the construction of this balloon; but at last, on the 1st December 1783, it was taken to the Tuileries and there filled with gas. The process was slow, as the gas had to be generated in large quantities by means of diluted sulphuric acid and iron filings put into wooden casks disposed round a large cistern, from which it was conveyed through water in long leaden pipes. To keep the impatient populace quiet, therefore, during the tedious operation, Montgolfier sent up one of his fire-balloons.

At last, when it was sufficiently filled, MM. Charles and Robert stepped into the car, which was ballasted with sand-bags, and the ropes were let go. It went up with slow and solemn motion, at the rate of about five miles an hour. "The car," writes a reporter of the day in language more inflated than the balloon itself, "ascending amidst profound silence and admiration, allowed, in its soft and

measured ascent, the bystanders to follow with their eyes and hearts two interesting men, who, like demigods, soared to the abode of the immortals, to receive the reward of intellectual progress, and carry the imperishable name of Montgolfier. After the globe had reached the height of 2000 feet, it was no longer possible to distinguish the aërial navigators; but the coloured pennants which they waved in the air testified their safety and their tranquil feelings. All fears were now dissipated; enthusiasm succeeded to astonishment; and every demonstration was given of joy and applause."

The period of flight was an hour and three-quarters, which, for those early days of the art, was a pretty long voyage. By throwing over ballast the voyagers ascended, and by letting off gas they descended at pleasure; and they observed that during an hour, while they were exposed to the sun's rays, the gas was heated up to the temperature of fifty-five degrees of Fahrenheit's scale, which had the effect of sensibly increasing the buoyancy of the balloon. They descended safely on the meadow of Nesle, about twenty-five miles from Paris.

But, not content with what he had accomplished, M. Charles made a sudden resolve to have another flight alone. The shades of night were falling, and the sun had already set, when the enthusiastic aëronaut re-entered the car, and, casting off the grapnels, began his solitary night voyage. He was well rewarded. The balloon shot up with such

celerity as to reach the height of about two miles in ten minutes, and the sun rose again to him in full orb! From his lofty station he watched it until it set again below the distant horizon. Probably M. Charles was the first man in the world on whom the sun thus rose and set twice in the same day!

In such regions, at that romantic period of night, the aëronaut, as might have been expected, saw strange unearthly sights. Rising vapours concealed the lower world from view, and the moon shed her pale rays on accumulated masses of clouds, casting various hues over their fantastic and changing forms. No wonder that one thus surrounded by objects of awful grandeur and sublimity, left, as it were, more completely alone with God than any of his fellow-mortals, found it impossible to refrain from giving vent to his emotion in tears.

M. Charles did not remain long at this elevation. As the cold was excessive, and night advancing, he deemed it prudent to descend; opened the safety-valve, out of which the gas rushed like a misty vapour with a whistling noise, and, after the lapse of a little more than half an hour, alighted in safety near the wood of Tour du Lay, having travelled about nine miles.

After this, balloon ascents became frequent. We cannot here give a particular account of each, even if it were desirable to do so, but, before passing to the consideration of the more recent voyages, we shall run over a few facts and incidents that

occurred during the early period of aërial navigation.

The first lady who went up in a balloon was a Madame Thiblé. She ascended from Lyons on 28th June 1784 with a M. Fleurant in a fire-balloon. This lady of Lyons mounted to the extraordinary elevation of 13,500 feet—at least so it was estimated. The flagstaff, a pole of fourteen pounds weight, was thrown out and took seven minutes to reach the ground. The thermometer dropped to —43° Fahr., and the voyagers felt a ringing sensation in their ears.

The first long voyage accomplished was about the same period, by a balloon constructed by M. Robert, which was filled with hydrogen. It was 56 feet in height, and 36 in diameter. The Duke de Chartres ascended in it along with Robert and two others to a considerable height, and in five hours performed a voyage of 135 miles. This machine was furnished with a helm and four oars, for men still laboured under the erroneous belief that it was possible to direct the course of a balloon.

One of the most interesting balloon voyages of the last century was that of M. Testu. He ascended from Paris on the 18th June 1786 in a balloon of glazed tiffany, 29 feet in diameter, which was constructed by himself. It was filled with hydrogen, and had wings as well as oars! When the aëronaut deemed it advisable to descend, he attempted to do so by using the wings. These had little or no power,

but the gradual waste of gas lowered him until he alighted safely in a corn field in the plain Montmorency. Here he began to collect stones without quitting the car; but while thus engaged, was seized by the proprietor of the field with a troop of peasants, who demanded indemnification for the damage alleged to have been done by him. Poor Testu assured them that his wings being broken, he was at their mercy, whereupon the stupid and ill-natured boors seized the stay of the balloon, which floated some height above the ground, and dragged him in triumph towards their village. Their triumph, however, was short-lived. Finding that the loss of his wings and some other articles had lightened him considerably, he quietly cut the cord and bade the clowns an abrupt farewell!

Testu then rose to the clouds, where he experienced the violence and witnessed the grandeur of a thunderstorm, the terrible nature of which was greatly increased when night closed in, while lightning flashed on all sides, thunder reverberated in the sky, and sleet fell copiously around him. On this voyage he saw some hunters in a field, and descended to observe them! He remained out all night, saw the sun set and rise, and finally alighted near the village of Campremi, about sixty-three miles from Paris.

CHAPTER IV

THE FIRST AËRIAL VOYAGES MADE IN GREAT BRITAIN—SUCCEEDING ASCENTS

THE credit of the first aërial voyage made in Great Britain has usually been given to Vincenzo Lunardi, an Italian. There is ground for believing, however, that the first balloon voyage was performed by a Scotchman, as the following extract from Chamber's *Book of Days* will show:—

"It is generally supposed that Lunardi was the first person who ascended by means of a balloon in Great Britain, but he certainly was not. A very poor man, named James Tytler, who then lived in Edinburgh, supporting himself and family in the humblest style of garret or cottage life by the exercise of his pen, had this honour. He had effected an ascent at Edinburgh on the 27th of August 1784, just nineteen days previous to Lunardi. Tytler's ascent, however, was almost a failure, by his employing the dangerous and unmanageable Montgolfier principle. After several ineffectual attempts, Tytler, finding that he could not carry up

his fire-stove with him, determined, in the maddening desperation of disappointment, to go without this his sole sustaining power. Jumping into his car, which was no other than a common crate used for packing earthenware, he and the balloon ascended from Comely Garden, and immediately afterwards fell in the Restalrig Road. For a wonder, Tytler was uninjured; and though he did not reach a greater altitude than 300 feet, nor traverse a greater distance than half a mile, yet his name must ever be mentioned as that of the first Briton who ascended with a balloon, and the first man who ascended in Britain.

"Tytler was the son of a clergyman of the Church of Scotland, and had been educated as a surgeon; but being of an eccentric and erratic genius, he adopted literature as a profession, and was the principal editor of the first edition of the *Encyclopædia Britannica.* Becoming embroiled in politics, he published a handbill of a seditious tendency, and consequently was compelled to seek a refuge in America, where he died in 1805, after conducting a newspaper at Salem, in New England, for several years."

The voyage of Vincenzo Lunardi was made in September 1784. His letters to a friend, in which he comments on the manners and customs of the English, are very amusing. His balloon was of the ordinary spherical shape, made of the best oiled silk, about 520 yards of which were used in its con-

struction. It was filled with hydrogen gas, and provided with car, oars, and wings. The car consisted simply of a wooden platform surrounded by a railing breast high, and the oars and wings were intended, the one to check, by a vertical motion, the rapidity of descent, and the other to act as sails when becalmed in the upper regions of cloudland. He requested permission to make Chelsea Hospital the scene of his first aërial exploit, and the Governor, Sir George Howard, with the full approval of His Majesty King George III., gave his consent. He accordingly made all necessary arrangements for an ascent, and his fondest expectations seemed about to be realised. He was, however, doomed to disappointment, owing to the failure of a rival balloon. Writing to a friend at this time he says, "The events of this extraordinary island are as variable as its climate. It was but lately everything relating to my undertaking wore a favourable and pleasing appearance, but I am at this moment overwhelmed with anxiety, vexation, and despair."

This rival balloon was constructed by a Frenchman named De Moret, who, having succeeded in attracting a concourse of fifty or sixty thousand people to see his ascent, failed in the primary part of his undertaking,—that of filling his balloon. The people, after waiting patiently for three hours, and supposing "the whole affair an imposture, rushed in and tore it to pieces." In consequence of this failure, and the riots with which it was followed, the

Governor forbade Signor Lunardi to make his ascent from Chelsea Hospital grounds. He writes again to his friend, "The national prejudice of the English against France is supposed to have its full effect on a subject from which the *literati* of England expect to derive but little honour. An unsuccessful attempt has been made by a Frenchman, and my name being that of a foreigner, a very excusable ignorance in the people may place me among the adventurers of that nation, who are said to have sometimes distinguished themselves here by ingenious impositions." In vain did he try to obtain another place to launch his aërial ship; he was laughed at and ridiculed as an impostor, and the colleague of De Moret. At length, after much exertion, he obtained leave to ascend from the ground of the Honourable Artillery Company. By twelve o'clock on the day fixed for the ascension, an immense mass of people had assembled, including the Prince of Wales. The filling of the balloon caused some delay but in order to keep the patience of the populace within control, it was only partially filled. At five minutes past two the balloon ascended amid the loud acclamations of the assembled multitudes, and Signor Lunardi had proved himself no impostor. He writes to his friend, "The stillness, extent, and magnificence of the scene rendered it highly awful. My horizon seemed a perfect circle, the terminating line several hundred miles in circumference; this I conjectured from the view of London, the extreme

points of which formed an angle only a few degrees. It was so reduced on the great scale before me that I can find no simile to convey an idea of it. I could distinguish St. Paul's and other churches from the houses; I saw the streets as lines, all animated with beings whom I knew to be men and women, but which otherwise I should have had a difficulty in describing. It was an enormous bee-hive, but the industry of it was suspended. All the moving mass seemed to have no object but myself, and the transition from the suspicion, perhaps contempt, of the preceding hour, to the affectionate transport, admiration, and glory of the present moment, was not without its effect on my mind. It seemed as if I had left below all the cares and passions that molest mankind. I had not the slightest sense of motion in the machine; I knew not whether it went swiftly or slowly, whether it ascended or descended, whether it was agitated or tranquil, but by the appearance or disappearance of objects on the earth. The height had not the effect which a much less degree of it has near the earth, that of producing giddiness. The gradual diminution of objects, and the masses of light and shade, are intelligible in oblique and common prospects, but here everything wore a new appearance and had a new effect. The face of the country had a mild and permanent verdure to which Italy is a stranger. The variety of cultivation and the accuracy with which property is divided give the idea, ever present to the stranger in England, of

good civil laws and an equitable administration. The rivulets meandering; the immense districts beneath me spotted with cities, towns, villages, and houses, pouring out their inhabitants to hail my appearance. You will allow me some merit in not having been exceedingly intoxicated with my situation." He descended at North Mimms about half-past three-o'clock, but wishing to obtain a second triumph, he threw out the remainder of his ballast and provisions, landed a cat which he had taken up with him, and which had suffered severely from the cold, and again ascended to the regions above. This time his ascent was more rapid, the thermometer quickly fell to 29°, and icicles were soon formed all round his machine. He descended at twenty minutes past four near Ware in Hertfordshire, and the balloon being properly secured, the gas was let out and "nearly poisoned the whole neighbourhood by the disagreeable stench emitted." The success and triumph of this first attempt in aërial navigation in English air exceeded Signor Lunardi's utmost expectations. Everywhere he was received with marks of approbation, and treated as a hero. "My fame," he writes, "has not been sparingly diffused by the newspapers (which in England are the barometers of public opinion; often erroneous, as other instruments are, in their particular information, but yielding the best that can be obtained). You will imagine the importance of these vehicles of knowledge when you learn that in London alone there are

printed no less than 160,000 papers weekly, which, by a stamp on each paper, and a duty on advertisements, brings into the treasury of the nation upwards of £80,000 a year. They are to the English constitution what the Censors were to those of ancient Rome. Ministers of State are checked and kept in awe by them, and they freely, and often judiciously, expose the pretensions of those who would harass Government merely to be taken into its service."

There were many other aëronauts who distinguished themselves after this period.

In 1785, M. Blanchard, with Dr. J. Jeffries, an American, crossed the channel between England and France in a balloon—starting from Dover, and descending in safety in the Forest of Guiennes. They had, however, a narrow escape, having been compelled to throw out all their ballast, and everything they could dispense with, to prevent their balloon from falling into the sea.

The first ascents for scientific purposes were made about the beginning of the present century. In 1803, Mr. Robertson ascended from St. Petersburg, for the purpose of making electrical, magnetical, and physiological experiments. MM. Gay-Lussac and Biot followed his example from Paris, in 1804. Gay-Lussac was an enthusiastic and celebrated aëronaut. He made several interesting ascents.

Two years afterwards, Brioschi, the Astronōmer-Royal at Naples, endeavoured to ascend to a higher

elevation than had been reached by M. Gay-Lussac —namely, 22,977 feet. He was accompanied by Signor Andreani, the first Italian aëronaut. The balloon burst when at a great height, but the remnants were sufficient to check the descent so much that both gentlemen escaped with their lives. Brioschi, however, received injuries which afterwards resulted in his death.

In England one of the most famous aëronauts was Mr. Green, who introduced coal gas for balloons, and made many hundreds of ascents. In the year 1836 he ascended from London in a coal-gas balloon and with two other gentlemen made an aërial voyage to Weilburg in the grand Duchy of Nassau. It lasted eighteen hours, and extended over 500 miles.

CHAPTER V

PARACHUTES

OF the other voyages which were made in balloons in our own country and in foreign lands about this period we shall say nothing, but, before describing the most interesting of recent ascents, give a short account of the parachute.

This contrivance has been considered by some a very important adjunct to the balloon; whether it be so or no, we do not pretend to determine, but certainly it is an interesting and curious machine, which merits notice.

The parachute may be described as a species of gigantic umbrella attached to the balloon below the car, which hangs in a loose form while ascending, but expands, of necessity, when cut adrift and allowed to descend. As the balloon has a car hung beneath it, so in like manner the parachute has a small car or basket, capable of holding one person, suspended from it. The word signifies *a guard against falling*—from the French *parer*, to ward off, and *chute*, a fall, and is allied to *parasol*, which means literally "a warder off of the sun."

The parachute was introduced some years after a terrible accident which occurred to the celebrated aëronaut Rozier, who, desirous of emulating Blanchard and Jeffries by crossing the channel from France to England in a balloon, made an attempt, which cost him his life. Rozier's balloon was about forty feet in diameter, and had attached to it, beneath, a smaller balloon on the Montgolfier principle. On the 15th of June 1785, he entered the car with M. Romain, and ascended to the height of above three thousand feet, when it was observed by the spectators that the lower balloon had caught fire. With horror they saw that the fire spread—the whole apparatus was in a blaze—and in another minute it descended like a shattered meteor to the ground with a terrible crash. It fell near the sea-shore, about four miles from Boulogne, and of course the unfortunate voyagers were killed instantaneously. At a later period a Venetian nobleman and his lady fell with their balloon from a great height and were killed. It must be remarked, however, that cases of this kind were very rare, considering the rage which there was at that period for ballooning.

In order to provide aëronauts with a means of escape—a last resource in case of accident—the parachute was invented. It may be regarded as a balloon's lifeboat, which will (perhaps!) bear the passengers in safety to the ground in case of balloon-wreck.

THE PARACHUTE.

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Doubtless the umbrella suggested the parachute. Every one knows the tremendous force that this implement exerts in a high wind if the unfortunate owner should happen to get turned round in the wrong direction. The men of the east have, it is said, turned this power to account by making use of an umbrella to enable them to leap from considerable heights. In particular, a native of Siam, who was noted for his feats of agility, was wont to amuse the King and his court by taking tremendous leaps, having two small umbrellas with long slender handles attached to his girdle. These eased him down in safety, but he was occasionally driven by the wind against trees or houses, and sometimes into a neighbouring river.

In case any adventurous individual should be tempted to make trial of the powers of himself and his umbrella in this way, we think it right, by way of caution, to tell him that the French General Bournonville, who was imprisoned in the fortress of Olmutz in 1793, became so desperate that he attempted to regain his freedom by leaping with an umbrella from his window, which was forty feet from the ground. He hoped that the umbrella would break his fall. Doubtless it did so to some extent, and saved him from being killed, but being a large heavy man, he came down with sufficient violence to break his leg, and was carried back to his dungeon.

The chief differences between a parachute and an

umbrella lie in the great size of the former, and in the cords which stretch from the outer points of its ribs to the lower end of the handle. These cords give it strength, and prevent it from turning inside out. There is also a hole in the top of the parachute to allow some of the air to escape.

The first parachute was constructed by Blanchard in 1785, and a dog was the first living creature that descended in it, and reached the earth unhurt. Blanchard afterwards made a descent in person at Basle, and broke his leg in the fall.

The bold aëronaut M. Garnerin next ventured to make the perilous descent. He visited London in 1802, and made several ascents in a balloon. During one of these, on the evening of the 2d November, he cut himself adrift in his parachute when at a vast height. The parachute was made of white canvas, having thirty-two gores, which, when not in use, hung with its cords from a hoop near the top of the machine. When expanded, it formed a vast umbrella of twenty-three feet in diameter, with a small basket about four feet high, and two and a quarter wide, suspended below it. M. Garnerin stood in this basket when his balloon mounted into the air from an enclosure near North Audley Street. The parachute hung like a curtain over his head, above it towered the balloon, beneath stood the anxious multitude.

Well might they gaze in breathless expectation! After floating for some time in the upper regions

of the air, as if he dreaded to make the bold attempt, he cut the cord that fastened him to the balloon when at the height, probably, of about half a mile. At first the parachute remained closed and descended with frightful violence; then it burst open, and for some seconds tossed about to such an extent that the basket was sometimes thrown almost into a horizontal position. The wind carried it over Marylebone and Somerstown; it almost grazed some of the houses of St. Pancras in passing, and finally came to the ground in a field with such violence that poor Garnerin was thrown on his face and severely cut and bruised. No wonder that we are told he received a terrible shock. He trembled violently, and blood flowed from his nose and ears. Nevertheless, the accident did not deter his daughter from afterwards making the descent several times—and in safety.

The cause of the irregularity and violence of Garnerin's descent was the giving way of one of the stays, which had the effect of deranging the balance of the apparatus.

In 1837 Mr. Cocking invented a new parachute, which he hoped would be free from the faults of the other. It may be described as being the reverse of that of Garnerin, being made in the form of an umbrella blown inside out. The resistance to the air, it was thought, would be sufficient to check the rapid descent, while its form would prevent the tendency to oscillate.

This parachute was 34 feet in diameter, and was distended by a strong hoop to prevent its closing. There was also a hole in the middle of it, about 6 feet in diameter. Mr. Cocking started from Vauxhall Gardens on the 24th of July, and after ascending to a considerable height, cut himself loose from his balloon when over Blackheath. The parachute descended rapidly and vibrated with great violence; the large hoop broke, the machine collapsed, and the unfortunate aëronaut was killed, and his body dreadfully mutilated.

Fatal accidents of this kind were to be expected; nevertheless it is a fact that the disasters which have befallen aëronauts have been comparatively few, considering the extreme danger to which they are necessarily exposed, not only from the delicacy of the materials with which they operate and the uncertainty of the medium through which they move, but, particularly, because of the impossibility of giving direction to their air-ships, or to arrest their progress through space. Parachutes, however, are not so absolutely incapable of being directed as are balloons. M. Nadar writes on this point as follows:—

"Let us consider the action of the parachute.

"A parachute is a sort of umbrella, in which the handle is replaced at its point of insertion by an opening intended to ease the excess of air, in order to avoid the strong oscillations, chiefly at the moment at which it is first expanded. Cords,

departing symmetrically from divers points of the circumference, meet concentrically at the basket in which is the aëronaut. Above this basket, and at the entrance of the folded parachute, that is to say closed during the rise, a hoop of sufficient diameter is intended to facilitate, at the moment of the fall, the entrance of the air which, rushing in under the pressure, expands the folds more easily and rapidly.

"Now the parachute, where the weight of the car, of the attaching cords, and the wrigglings of the aëronaut, is in equilibrium with the expansion—the parachute, which seems to have no other aim but to moderate the shock in falling—the parachute even has been found capable of being directed, and aëronauts who have practised it, take care not to forget it. If the current is about to drive the aëronaut over a place where the descent is dangerous —say a river, a town, or a forest—the aëronaut perceiving to his right, let us suppose, a piece of ground suitable for his purpose, pulls at the cords which surround the right side, and by thus imparting a greater obliquity to his roof of silk, glides through the air, which it cleaves obliquely, towards the desired spot. Every descent, in fact, is determined by the side on which the incline is greatest."

That these are not mere theoretical opinions or conjectures is certain from the fact that Madlle. Garnerin once wagered to guide herself with a parachute from the point of separation from her

balloon to a place determined and very remote. By the combined inclinations which could be given to her parachute, she was seen in fact, very distinctly, to manœuvre and tend towards the appointed place, and succeeded at length in alighting within a few yards of it.

CHAPTER VI

ASCENTS BY MESSRS. GLAISHER AND COXWELL

WE now come to that point in our subject where it is appropriate to give more detailed and graphic accounts of the recent doings of aëronauts.

An extremely interesting description of a scientific balloon ascent is given by the celebrated aëronaut, Mr. Glaisher, in a pamphlet, from which we shall make a few extracts.[1] His description is illustrative of the subject of ballooning, and contains the salient points of several ascents.

He asks us to imagine the balloon somewhat more than half inflated, eager for flight, with only one link connecting it with earth, namely, a rope attached to an instrument, called a liberating iron catch. When all the ballast, instruments, etc., were placed in the car, Mr. Coxwell brought the balloon to a *nice* and *even* balance, so that the addition of twenty pounds would have prevented it from rising.

[1] *Exeter Hall Lectures—Scientific Experiments in Balloons*, by James Glaisher, Esq., F.R.S.—Published by James Nisbet and Co., London.

As the moment for departure drew near, friends became impatient, and every one anxiously watched the final arrangements, which were made by Mr. Coxwell, on whom was laid the important duty of *letting go*. His hand was on the catch, his countenance was fixed, and his expression stern, as he gazed up into the heavens. He was waiting for the right moment, for the sky was partially cloudy, and it was necessary to wait until the balloon was midway between the cloud that had just passed and the next that was approaching, so that the aëronauts might have a clear sky, and be able to see the earth they were about to quit for a time. Nor was this all; he knew that in every wind, however strong it might be, there are periods of calm. If he could start in one of these he would avoid much rotatory motion. The deciding, therefore, of the exact moment for making a fair start was not so easy a matter as one might suppose.

Some one at this critical time, with the characteristic eagerness of poor human nature to "put its finger in the pie," cried out "Now!" and another shouted "Pull!" but Mr. Coxwell, regardless of every one, decided for himself; and, just when the wind lulled and the sun shone bright, and the balloon stood proudly erect, he pulled the trigger and they were free.

But they were more than free. They were suddenly in profound repose, for—however high the wind may be, however agitated the balloon, sway-

ing to and fro with sudden and violent action, despite the efforts of many hands that endeavour to restrain it,—no sooner do aëronauts quit their hold of earth, than, in an instant, all agitation ceases and they are in perfect stillness, without any sense of motion whatever; and this freedom continues throughout the entire flight—except, indeed, when they sink so low as to come into contact with mother earth, when the serenity of their flight is terribly and violently interrupted, as shall be seen in the case of another balloon voyage hereafter to be described.

They were now fairly away, but we pause to remark, before joining them in their voyage, that their object on this occasion was not merely amusement—scientific investigation and experiment were their aim. In order that the reader may have some idea of the nature of such, we subjoin Mr. Glaisher's list of the objects of his experiments:—

The primary objects were, he says, "to determine, at various heights, up to five miles—*first*, the pressure of the atmosphere; *second*, the temperature of the air; *third*, the hygrometrical (or moist-measured) states of the air."

The secondary objects were:—

"To compare the readings of an aneroid barometer with those of a mercurial barometer, up to five miles.

"To determine the electrical state of the air.

"To determine the oxygenic state of the atmosphere by means of ozone papers.

"To determine the time of vibration of a magnet on the earth, and at different distances from it.

"To determine the temperature of the dew point by Daniell's dew point hygrometer and Regnault's condensing hygrometer, and by the use of the dry and wet bulb thermometers, as ordinarily used, and their use when under the influence of the aspirator, causing considerable volumes of air to pass over both their bulbs, at different elevations, as high as possible, but particularly up to heights where man may be resident, or where troops may be located, as in the high table-lands and plains of India; with the view of ascertaining what confidence may be placed in the use of the dry and wet bulb thermometers at those elevations, by comparison with Daniell's and Regnault's hygrometers; and also to compare the results as found by the two hygrometers together.

"To collect air at different elevations.

"To note the height and kind of clouds, their density and thickness at different elevations.

"To determine the rate and direction of different currents in the atmosphere if possible.

"To make observations on sound.

"To note atmospherical phenomena in general, and to make general observations."

With these objects in view the aëronauts left *terra firma* and soared into the skies.

"Once away," says Mr. Glaisher, "we are both immediately at work; we have no time for graceful

acknowledgments to cheering friends. Mr. Coxwell must put the car in order, and accordingly looks to it, to his balloon, and to the course we are taking; and I must get my instruments in order, and without delay place them in their situations, adjust them, and take a reading as soon as possible.

"In a few minutes we are from 1000 to 2000 feet high. Mr. Coxwell looks intently upwards to see how the huge folds of the balloon fill into the netting. If we have started from a town, we now hear its busy hum, and the now fast fading cheers of our assembled friends naturally attract our attention. We behold at a glance the quickly-diminishing forms of the objects which we so lately left, and then resume our work.

"Presently Mr. Coxwell, who is always alive to the beauties of the ever-varying scene below, and to the opening landscape, fixes his eye upon me, and, just when a rural scene of surpassing beauty is lighted up in the west, he summons me to look and admire. I struggle against picturesque temptations, somewhat at variance with my duties, but cannot so quickly suppress them. A fine cloud rears its Alpine cap in close proximity to the car; Mr. Coxwell looks as delighted as an artist when he displays a magnificent painting. I feel I must conquer such enchantment, and exclaim, 'Beautiful! grand indeed!' and again resume my observations, with a cold philosophic resolve to pursue my readings without further interruption.

"For a while I am quiet, the instruments affording indication that we are rising rapidly. Mr. Coxwell again disturbs me just as we are approaching the clouds, and recommends a farewell peep at mother earth; and just as I take this, the clouds receive us, at first in a light gauze of vapour, and then in their chilly embrace, where I examine their structure, and note the temperature of the dew point particularly.

"Shortly it becomes lighter, the light gradually increasing, till it is succeeded by a flood of light, at first striking, then dazzling, and we pass out of the dense cloud to where the clouds open out in bold and fantastic shapes, showing us light and shadow, and spectral scenes, with prismatic embellishments, disporting themselves around us in wild grandeur, till at length we break out into brilliant sunshine, and the clouds roll away in a perfect sea of vapour, obscuring the earth entirely; so that now in perfect silence I note the circumstances, and make my observations for some time uninterruptedly.

"After a time Mr. Coxwell directs my attention to the fact that the balloon is full, and that the gas is coming out from the safety-valve. I of course look, for this is an exciting moment. He then directs my attention to the fit and proportions of the netting. I find the gas, which was before cloudy and opaque, is now clear and transparent, so that I can look right up the balloon and see the meshes of the net-work showing through it, the upper valve

with its springs and line reaching to the car, and the geometrical form of the balloon itself. Nor is this an idle examination. I have already said that, in passing through the cloud, the netting would gather moisture, augmenting the weight of the balloon. If this should not all have evaporated, the network would have become frozen, and be a wire-rope; so that, if the diamond shape of the netting when under tension, and the form of the crown of the balloon, be not symmetrical, the weight might not be equally distributed, and there would be danger of it cutting the balloon. A sense of security therefore follows such an examination.

"A stream of gas now continually issues from the neck, which is very capacious, being fully two square feet in area, which is always left open. Presently I see Mr. Coxwell, whose eye has been continually watching the balloon, pass his fingers over the valve line, as if in readiness to pull the cord. I observe a slight gathering on his brow, and look inquiringly at him. He says, 'I have decided upon opening the large upper valve,' and carefully explains why. 'The tension,' he says, 'in the balloon is not greater than it would bear with safety in a warm stratum of air; but now that we are three miles up with a chilled balloon, it is better to allow some to escape at top, as well as a good deal from the neck.' At once I see the force of the argument, and inwardly infer that I am in no way dependent upon chance, and not likely to suffer from carelessness

with Mr. Coxwell. We are now far beyond all ordinary sounds from the earth; a sea of clouds is below us, so dense that it is difficult to persuade ourselves that we have passed through them. Up to this time little or no inconvenience is met with; but on passing above four miles, much personal discomfort is experienced; respiration becomes difficult; the beating of the heart at times is audible; the hands and lips become blue, and at higher elevations the face also; and it requires the exercise of a strong will to make and record observations. Before getting to our highest point, Mr. Coxwell counts the number of his sand-bags, and calculates how much higher we can go, with respect to the reserve of ballast necessary to regulate the descent.

"Then I feel a vibration in the car, and, on turning round, see Mr. Coxwell in the act of lowering down the grapnel, then looking up at the balloon, then scanning the horizon, and weighing apparently in his mind some distant clouds through which we are likely to pass in going down.

"A glance suffices to show that his mind is made up how much higher it is prudent to rise, and how much ballast it is expedient to preserve.

"The balloon is now lingering, as it were, under the deep blue vault of space, hesitating whether to mount higher or begin its descent without further warning. We now hold a consultation, and then look around from the highest point, giving silent scope to those emotions of the soul which are natu-

rally called forth by such a wide-spread range of creation.

"Our course is now about to change. But here I interpose with 'No, no; stop; not yet; let us remain so long that the instruments are certain to take up the true temperature, and that no doubt can rest upon the observations here. When I am satisfied I shall say, "Pull."'

"Then in silence—for here we respire with difficulty, and talk but little—in the centre of this immense space, in solitude, without a single object to interrupt the view for 200 miles or more all round, abstracted from the earth, upheld by an invisible medium, our mouths so dry we cannot eat, a white sea below us, so far below, we see few, if any, irregularities. I watch the instruments; but, forcibly impelled, again look round from the centre of this vacuity, whose boundary-line is 1500 miles, commanding nearly 130,000 square miles, till I catch Mr. Coxwell's eye turned towards me, when I again direct mine to the instruments; and when I find no further changes are proceeding, I wave my hand and say, 'Pull.'

"A deep resonant sound is heard overhead; a second pull is followed by a second report, that rings as with shrill accompaniment down the very sides of the balloon. It is the working of the valve, which causes a loud booming noise, as from a sounding-board, as the springs force the shutters back.

"But this sound in that solitary region, amid

silence so profound that no silence on earth is equal to it,—a drum-like sound meeting the ear from above, from whence we do not usually hear sounds —strikes one forcibly. It is, however, one sound only; there is no reverberation, no reflection; and this is characteristic of all sounds in the balloon, —one clear sound continuing during its vibrations, then gone in a moment. No sound ever reaches the ear a second time. But though the sound from the closing of the valve in those silent regions is striking, it is also cheering,—it is reassuring; it proves all to be right, that the balloon is sound, that the colder regions have not frozen tight the outlet for gas, and that we are so far safe. We have descended a mile, and our feelings improve with the increase of air and warmth. But silence reigns supreme, and Mr. Coxwell, I observe, turns his back upon me, scanning intently the cloudscape, speculating as to when and where we shall break through and catch sight of the earth. We have been now two hours without seeing *terra firma*. How striking and impressive is it to realise a position such as this; and yet as men of action, whose province it is to subordinate mere feelings, we refrain from indulging in sentiment. I say refrain, for presently Mr. Coxwell breaks out, no longer able to contain himself: 'Here, Mr. Glaisher, you must welcome another balloon. It is the counterpart of our own.' This spectral balloon is charming to look upon, and presents itself under a variety of imposing aspects, which are

magnified or diminished by the relative distance of our balloon from the clouds, and by its position in relation to the sun, which produces the shadow. At mid-day it is deep down, almost underneath; but it is more grandly defined towards evening, when the golden and ruby tints of the declining sun impart a gorgeous colouring to cloudland. You may then see the spectre balloon magnified upon the distant cloud-tops, with three beautiful circles of rainbow tints. Language fails utterly to describe these illuminated photographs, which spring up with matchless truthfulness and choice decoration.

"Just before we enter the clouds, Mr. Coxwell, having made all preparations for the descent, strictly enjoins me to be ready to put up the instruments, lest, when we lose the powerful rays of the sun, and absorb the moisture of the lower clouds, we should approach the earth with too great rapidity.

"We now near the confines of the clouds, and dip swiftly into the thickest of them; we experience a decided chill, and hear the rustling of the collapsing balloon, which is now but one-third full, but cannot see it, so dense is the mass of vapour. One, two, three, or more minutes pass, and we are still in the cloud. How thick it must be, considering the rapidity of the descent! Presently we pass below, and the earth is visible. There is a high road intersecting green pastures; a piece of water looking like polished steel presents itself; a farmhouse, with stacks and cattle, is directly under us. We see the

sea-coast, but at a distance. An open country lies before us. A shout comes up, and announces that we are seen, and all goes well, save the rapidity of our descent, which has been caused by that dark frowning cloud which shut us out from the sun's rays, and bedewed us with moisture. Mr. Coxwell, however, is counteracting it by means of the ballast, and streams out one bag, which appears to fly up instead of falling down; now another is cast forth, but still it goes up, up. A third reduces the wayward balloon within the bounds of moderation, and Mr. Coxwell exultingly exclaims that 'he has it now under perfect command, with sand enough, and to spare.'

"Delighted to find the balloon is thus checked, as it is favourable to good readings of the several instruments at this elevation, I work as quickly as I can, noticing also the landscape below; rich mounds of green foliage, fields of various shades of green, like a tessellated pavement in motion; with roads, rivers, rivulets, and the undulatory nature of the ground varying the scene every instant. Should our passage be over a town, it is like a model in motion; and all is seen with a distinctness superior to that from the earth; the line of sight is through a purer and less dense medium; everything seems clearer, though smaller; even at the height of four miles above Birmingham we distinguished the New Street Station and the streets.

"We have been descending slowly for a little

time, when I am challenged to signify when I can close my observations, as yonder, about two miles distant, is a fine park, where Mr. Coxwell's eye seems to wander with something like a desire to enter it. I approve of the spot, as it is in every way suitable for a descent. The under-current, which is oftentimes stronger than the upper, is wafting us merrily in that direction. We are now only a few hundred feet above the surface. 'Put up your instruments,' cries Mr. Coxwell, 'and we will keep on this level until you are ready.'

"A little more sand is let out, and I pack up the instruments quickly in their wadded cases. 'Are you all right?' inquires the aëronaut. 'All right,' I respond. 'Look out then, and hold fast by the ropes, as the grapnel will stop us in that large meadow, with the hedgerow in front.'

"There, sure enough, we land. The cattle stand at bay affrighted, their tails are horizontal, and they run wildly away. But a group of friends from among the gentry and villagers draws up near the balloon, and although some few question whether we belong to this planet, or whether we are just imported from another, yet any doubt upon this point is soon set at rest, and we are greeted with a hearty welcome from all when we tell our story, how we travelled the realms of space, not from motives of curiosity, but for the advancement of science, its applicability to useful purposes, and the good of mankind."

In commenting on the several ascents thus combined in one description, Mr. Glaisher gives us various pieces of information which are highly interesting. The clouds, he says, on which the sun was shining brightly, each moment opened up to view deep ravines, and shining masses appeared like mountain ranges, some rising perpendicularly from rolling seas or plains, with summits of dazzling brightness, some pyramidal, others undulatory, with deep shadows between.

While passing over London on one occasion at night, at the height of about one mile, he heard the hum of the great city, and saw its lights. The river looked dull, but the bridges that spanned it, and the many miles of straight, intersecting, and winding streets were distinctly visible.

In referring to sound, he tells us that, on different occasions, at a height of 11,800 feet above the earth, a band was heard playing. At between four and five thousand feet a railway whistle and the shouting of people were heard, and at 10,070 feet the report of a gun. A dog was also heard barking at a height of two miles. At a height of 19,000 feet the hands and lips were observed, during one ascent, to be of a dark bluish colour. At four miles the palpitations of the heart were audible, and the breathing was affected. Considerable difficulty was experienced in respiration at higher elevations. From his various observations he found that the effect of high elevation is different upon the same individuals

at different times, and believed that, up to heights less than three miles—to which persons of ordinary self-possession might ascend—delicate and accurate scientific observations might be made with ease, but at heights approaching to four miles, such observations could not be made so well, because of the personal distress of the observer, and on approaching to five miles above the earth it required the exercise of a strong will to take any observations at all.

The most wonderful and alarming of the experiences of Mr. Glaisher appear to have occurred to him and his companion, Mr. Coxwell, during an ascent made from Wolverhampton on the 5th September, when they reached the enormous elevation of between six and seven miles.

They felt no particular inconvenience until after passing above the fifth mile. When at a height of 26,000 feet, Mr. Glaisher could not see the column of mercury in the tube, then the fine divisions on the scale of the instrument became invisible. Shortly afterwards he laid his arm on the table, and on attempting again to use it found that the limb was powerless. He tried to move the other arm, and found that it also was paralysed. He then tried to shake himself, and succeeded in shaking his body, but experienced the curious sensation of having no legs! While in this condition he attempted to look at the barometer, and, while doing so, his head fell on his left shoulder. Struggling to get out of this lethargic state, he found

that he could still shake his body, although he could not move either arms or legs. He got his head upright for an instant, but it dropped again on his shoulder, and he fell backwards, his back resting against the side of the car, and his head on its edge.

In this position his eyes were directed to Mr. Coxwell, who did not at first observe the state of his companion, in consequence of his having had to ascend into the ring of the balloon to disentangle the valve-line, which had become twisted. Hitherto Mr. Glaisher had retained the power of moving the muscles of his back and neck, but suddenly this was lost to him. He saw Mr. Coxwell dimly in the ring, and attempted to speak to him, but could not do so. A moment later intense black darkness surrounded him—the optic nerve had lost its power! He was still conscious, however, and with his brain as active as at other times. He fancied he had been seized with asphyxia, and that death would quickly ensue unless they descended without delay. Suddenly the power of thought ceased, and he became unconscious. All these extraordinary and alarming sensations, he calculated, must have taken place within five or six minutes.

While still powerless he heard the words "temperature" and "observation," and knew that Mr. Coxwell was in the car endeavouring to arouse him. Presently he heard him speak more emphatically, but could neither see, reply, nor move. Then he

heard him say, "Do try now, do," after which vision slightly returned, and in a short time he saw clearly again, rose from his seat, looked round, and said to Mr. Coxwell, "I have been insensible." His friend replied, "You have, and I too very nearly." Mr. Coxwell had lost the use of his hands, which were black; Mr. Glaisher, therefore, poured brandy over them. His companion then told him that, on descending from the ring, he thought he had laid himself back to rest, but noticing that his legs projected, and his arms hung down by his side, it struck him there was something wrong, and he attempted to go to his assistance, but felt insensibility coming over himself. He tried to open the valve, so that they might descend, but, having lost the use of his hands, could not. In this critical moment he seized the chord with his teeth, dipped his head two or three times, and thus succeeded in opening the valve and descending from those dangerous regions of attenuated atmosphere!

At first they went down at the tremendous rate of twenty miles an hour, but after descending three miles in nine minutes, the balloon's progress was checked, and they finally alighted safely in a grass field, where their appearance so terrified the country folk that it required a good deal of coaxing in plain English to convince them that the aëronauts were not inhabitants of another world!

CHAPTER VII

ACCOUNT OF NADAR'S BALLOON, "LE GÉANT." FIRST ASCENT

AS the "Giant" is the largest balloon that has yet been made, and as its experiences on the occasions of its first and second ascents were not only peculiar but terrible, we shall give an account of it in detail—commencing with its construction, and ending with the thrilling termination of its brief but wild career.

M. Nadar, a photographer of Paris, was the enthusiastic and persevering aëronaut who called it into being, and encountered the perils of its ascents, from which he did not emerge scatheless, as we shall see.

Besides being an experimental voyager in cloud-land, M. Nadar started a newspaper named *l'Aéronaute*, in which he gives an account of the "Giant," and his reasons for constructing it.

These latter were peculiar. He is emphatic in asserting that the huge balloon was never intended by him to be an "end," but a mere stepping-stone to

an end—which end was the construction of an *aëromotive*—a machine which was to be driven by means of a screw, and which he intended should supersede balloons altogether, so that his own "Giant" was meant to be the last of its race!

In reference to this, M. Nadar tells us that he was deeply impressed with the belief that the screw would ultimately become our aërial motor, but that, being ignorant of what it was likely the experiments of this first aëromotive would cost, he had resolved, instead of begging for funds to enable him to accomplish his great end, to procure funds for himself in the following manner:—

"I shall," says he, "make a balloon—the *last balloon*—in proportions extraordinarily gigantic, twenty times larger than the largest, which shall realise that which has never been but a dream in the American journals, which shall attract, in France, England, and America, the crowd always ready to run to witness the most insignificant ascent. In order to add further to the interest of the spectacle—which, I declare beforehand, without fear of being belied, shall be the most beautiful spectacle which it has ever been given to man to contemplate,—I shall dispose under this monster balloon a small balloon (*balloneau*), destined to receive and preserve the excess of gas produced by dilation, instead of losing this excess, as has hitherto been the case, which will permit my balloon to undertake veritable long voyages, instead

of remaining in the air two or three hours only, like our predecessors. I do not wish to ask anything of any one, nor of the State, to aid me, even in this question of general, and also of such immense, interest. I shall endeavour to furnish myself the two hundred thousand francs necessary for the construction of my balloon. The said balloon finished, by public ascents and successive exhibitions at Paris, London, Brussels, Vienna, Baden, Berlin, New York, and everywhere, I know that I shall collect ten times the funds necessary for the construction of our first aëromotive."

This first aëromotive, however, has not yet made its appearance, whether from want of funds or of practicability we do not know, but M. Nadar carried his designs triumphantly into effect with the "monster balloon," which in course of time made its appearance, performed flights, attracted the wonder and admiration, as well as a good deal of the coin, of hundreds of thousands in France and England, even conveyed royalty up into the clouds, broke the bones of its originator, and was exhibited in the great transept (which it nearly filled) of the Crystal Palace at Sydenham. While there we had the good fortune to behold it with our own eyes!

The construction of this balloon merits particular notice; but first, it may be remarked that it is well worthy of being named a giant, seeing that its height was only forty-five feet less than that of the towers of Notre Dame Cathedral, namely 196 feet.

That Nadar had cut out for himself an arduous task will be readily believed. Touching on this, he writes thus :—

"I have set myself to work immediately, and with difficulties, sleepless nights, vexations which I have kept to myself alone to this hour, and which some one of the days of this winter, the most urgent part of my task being finished, I shall in part make in confidence to my readers. I have succeeded in establishing my balloon, in founding at the same time this journal—indispensable *moniteur* to the aërial automotive—and in laying the basis of that which shall be, perhaps, the greatest financial operation of the age. Those who shall see and appreciate these labours, will please to pardon me, I hope, for having wiped my forehead with a little touch of pride, when at the end of a month—one month!—I have said to myself, 'it is done!'"

The "Giant" was composed of yellowish white silk, of which there were used 22,000 yards at about 5s. 4d. a yard, so that the cost of the silk alone was £5866. This was cut into 118 gores, which were entirely hand-sewed with a double seam, and some idea of the vastness of the work may be gathered from the fact that 200 women were employed during a month in the sewing of the gores. For the sake of greater strength the silk was doubled. In other words, there were *two* balloons of the same size, one within the other.

Directly beneath, and attached to its lower orifice,

there was a small balloon called a *compensator*, the object of which was to receive and retain for use the surplus gas. When a balloon rises to the higher regions of the atmosphere, the gas within it expands, so that a large quantity of it is allowed to rush out at the open mouth beneath, or at the safety-valve above. Were this not the case, the balloon would certainly burst. This loss of gas, however, is undesirable, because when the balloon descends the gas contracts, and the loss is then felt to be a great one. By collecting the over-flow of gas in the *compensator*, this disadvantage is obviated.

The car, which was made chiefly of wicker-work, was actually a small cottage of two storeys (a ground floor and platform or upper deck), with door and windows. Its height was about eight, and its length thirteen feet. The ground-floor contained a cruciform passage and six divisions. At one extremity was a captain's cabin with a bed in it, and underneath a compartment for luggage. At the other was the passengers' cabin, with three beds, one above the other. The four other divisions or rooms were a provision store, a lavatory, a place for conducting photographic operations, and a room for a small lithographic press, with which it was intended to print an account of the voyage, to be scattered about the localities over which they should pass!

In reference to this last, M. Nadar writes:—

"An English company a month ago (our neighbours are marvellous in not losing time), appreciating

the bustle which the sight of a balloon always excites in every inhabited place, and judging rightly that papers would never be better received and more greedily read than those thrown overboard by us, despatched a messenger to propose to me to accept commercial prospectuses. We shall never have too much money for the construction of our first aëromotive. I have accepted and made a contract."

Besides many miscellaneous articles, such as grapnels, fowling-pieces, speaking-trumpets, etc., that were to be carried up in this cot, there were provisions of all sorts, instruments for scientific observations, games, means of defence in case of descent among an inhospitable people, and two cages of carrier-pigeons sent from Liége. The car and all it contained was secured by twenty cables traversing on and beneath its walls, interlaced with the fabric and fastened to a large hoop just below the neck, to which hoop was also attached the ropes of the network by which the balloon itself was enveloped. There were two axles and four wheels connected with the car, by means of which it could, when necessary, be drawn along an ordinary road. Canes, disposed to act as springs, were placed underneath and round the middle of it to protect it from concussions, besides which internal buoys and an immense girdle in compartments of inflated india-rubber, rendered it incapable of submersion in water.

Such was the giant balloon in which M. Nadar and his friends made two ascents; of the first of

which (4th October 1863) Galignani writes thus:—

"The departure of this Leviathan of the airy regions attracted immense crowds to the Champ de Mars yesterday afternoon. Considering that the avenues encircling that vast space were filled to suffocation, so that we found it extremely difficult to force our way to the open ground reserved for tickets, and that all the housetops were occupied by spectators, we think the number of persons present may fairly be stated at 80,000. Ample precautions had been taken to prevent disasters,—a strong police force, supported by a company of infantry and some cavalry, being present to maintain order. The balloon, which is 90 yards in circumference, and has consumed upwards of 20,000 yards of silk in its manufacture, was held down, while filling, by about 100 men, and the weight of at least 200 sandbags. The car was of wicker-work, comprising an inner surface of about 54 square feet divided into three compartments or small rooms, surmounted by an open terrace, to which the balloon was braced. Outside, grapnels, wheels, and fowling-pieces, four of each, besides two speaking-trumpets, were lashed to the sides of the car. (The wheels were intended to be put to the car after alighting, in order to convey it back with horses.) The preliminary operations took considerable time, putting the patience of the spectators to a severe trial, a circumstance which perhaps prevented them from cheering when the words

'*Lâchez tout !*' were given, and the immense machine rose slowly and majestically into the air. We were rather surprised at the silence of the public, considering the very remarkable and interesting feat in aëronautics thus successfully performed. There were fifteen persons in the car or rather cabin :—M. Nadar, captain ; MM. Marcel, Louis and Jules Godard, lieutenants ; the Prince de Sayn-Wittgenstein, Count de St. Martin, M. Tournachon (Nadar's brother), MM. Eugène Delessert, Thirion, Piallat, Robert Mitchell, Gabriel Morris, Paul de St. Victor, de Villemessant, and one lady, the Princess de la Tour d'Auvergne. The Princess was taking her usual drive to the Bois de Boulogne, when, observing an unusual movement in the neighbourhood of the Invalides, and having inquired the cause, she ordered her coachman to drive to the Champ de Mars. Having seen the balloon, she expressed a wish to make the ascent, and although Nadar had to the last moment refused to take any lady, and even his own wife, he could not resist the entreaty of the Princess. On starting, M. Nadar climbed up the net-work and took off his hat to the spectators. The balloon took a north-easterly direction, and was visible for some time. At the moment of going to press, a communication has reached us signed by the captain, M. Nadar, and all those who had taken places in the balloon, stating that on alighting yesterday evening at nine o'clock at Barcy, near Meaux (Seine-et-Marne), three severe shocks were experienced, which had the effect

of completely capsizing the balloon, and inflicting on its occupants several rather severe contusions.

"Interesting details of the ascent of the Nadar balloon, said to have been narrated by Prince Wittgenstein, are given by the *France*. The most extraordinary is, that at half-past eight, when the balloon attained the height of 1500 mètres, the aëronauts saw the sun, which had set for the earth below upwards of two hours before. The effect of the light upon the balloon is described as something marvellous, and as having thrown the travellers into a sort of ecstacy. Although they met with no rain, their clothes were all dripping wet from the mist which they passed through. The descent was more perilous than at first reported. The car dragged on its side for nearly a mile, and the passengers took refuge in the ropes, to which they clung. Several were considerably bruised—though, as before stated, no one sustained any very serious injury. Everybody behaved well. Nadar, visibly uneasy about his fair charge, the young Princess de la Tour d'Auvergne, was told by her to attend to his duty as captain. 'Every one at his post,' said she; 'I will keep to mine.' Notwithstanding all the shaking which the car underwent, the 37 bottles of wine provided for the journey were all found unbroken, and they were most joyously broached when the party got on *terra firma*. The rifles, the crockery, as well as a cake and 13 ices, presented to Nadar by Siraudin, of the Rue de la Paix, were all uninjured. When the

descent was effected, the lights and the speaking-trumpets soon attracted a number of peasants, who brought carts and helped the party to the village of Barcy, where most of them passed the night; but M. Nadar and the Prince de Wittgenstein, with two or three others, came to Paris by the first train from Meaux.

"It is said that the descent was resolved upon in consequence of the advice of the brothers Godard, and contrary to the wish of M. Nadar, who, as captain, had made every one of his companions sign an agreement to act upon his orders, even though the vote should be unanimously against him. He, however, yielded his opinion, in deference to that of these experienced aëronauts. A truly extraordinary statement is, that they fancied the wind was blowing them to the sea, and certain destruction, whereas they were going due east, with no sea at all before them nearer than the Caspian.

"There was great disappointment in the receipts at the Champ de Mars, which are said to have realised only 27,000 francs, whereas 150,000 had been calculated upon. The papers say that the public broke down the barriers and got in for nothing, instead of paying their franc. It is quite certain that at the moment of the ascent there could not have been less than 50,000 people on the Champ de Mars, and on the terraces and heights around there must have been four times that number."

M. Nadar, on his return to Paris, wrote as follows:—

"Here, as briefly as possible, is the account which you asked me to send. Yesterday evening at nine o'clock, the 'Giant' was compelled to descend near the Barcy Marsh, two leagues from Meaux, after three violent shocks, the last of which completely turned everything in the car topsy-turvy, and it descended on its side. The rupture of our valve-pipe rope while travelling by night forced us to throw out our anchors. One of the prongs of the first anchor having broken, the principal anchor fortunately took hold of the ground. We were able to let out the gas, notwithstanding the violence of the wind, and the car was set up at half-past one in the morning. Some slight contusions and a concussion of the knee of one of the passengers—that is our receipt in full. It is not too dear.

"A. NADAR."

This bold and zealous aëronaut unfortunately paid dearer for his succeeding ascent as shall be seen in the next chapter.

CHAPTER VIII

SECOND ASCENT OF NADAR'S "GIANT" BALLOON

BEFORE describing the second ascent, which was decidedly the more adventurous, we shall give the rules laid down for his party by M. Nadar, which were remarkably stringent, and somewhat amusing:—

"1. Every traveller on board the 'Géant' must, before mounting, take knowledge of the present rules, and engage himself upon his honour to respect them, and to make them respected, both in the letter and in the spirit. He accepts and will obey this obligation until the descent.

"2. From the departure to the return there shall be only one command, that of the captain. That command shall be absolute.

"3. As legal penalty cannot be enforced, the captain, having the responsibility of the lives of the passengers, decides alone, and without appeal, in all circumstances, the means of assuring the execution of his orders with the aid of all under him. The captain can, in certain cases, take the advice of the crew, but his own authority is decisive.

"4. Every passenger declares, at the time of ascending, that he carries with him no inflammable materials.

"5. Every passenger accepts, by his simple presence on board, his entire part and perfect co-operation in all manœuvres, and submits himself to all the necessities of the service; above all, to the command of the captain. On landing, he must not quit the balloon without permission duly acquired.

"6. Silence must be absolutely observed when ordered by the captain.

"7. Victuals and liquors carried up by the travellers must be deposited in the common canteen, of which the captain alone has the key, and who regulates the distribution thereof. Passengers have no claim to victuals and liquors, except when on board.

"8. The duration of the journey is not limited. The captain alone decides the limitation; the same judgment decides, without appeal, the putting down of one or more travellers in the course of the voyage.

"9. All gambling is expressly prohibited.

"10. It is absolutely forbidden to any traveller to throw overboard ballast, or any packet whatever.

"11. No passenger can carry up with him luggage exceeding thirty lbs. in weight, and occupying more space than a travelling-bag.

"12. Except in very rare cases, of which the

captain alone shall be judge, it is absolutely forbidden to smoke on board, or on land within the vicinity of the balloon."

The second ascent took place on the 18th of October, when M. Nadar, nothing daunted by his former experience, again went up in his "Giant" from the Champ de Mars. On this occasion preliminaries were managed with greater success than on the former, and the event was regarded with much more general interest. Soldiers kept the ground; the Emperor himself was present, and conversed with the bold aëronaut on the subject of his balloon; George I. of Greece was there also, and the crowd which assembled to witness the ascent surpassed all expectation.

There were two peculiar features in this second ascent. It had been doubted whether the balloon, which was said to be capable of raising four-and-a-half tons, could carry more than thirteen men. In order to set this question at rest, a short preliminary flight was made with a rope attached to restrain the "Giant." About thirty soldiers were then put into the car, who mounted to the extent of the rope, and were pulled down again. The other feature was that a balloon of more ordinary dimensions was let fly along with the "Giant," to give, by contrast, a better idea of its size. The balloon used for this purpose was the "Godillot," which had been used by the Emperor in the Italian campaign for reconnoitring the enemy.

After the usual delays which are inseparable from such displays, M. Nadar, with eight friends, stepped into the car, the rope was let go, and the "Giant" rose slowly towards the clouds, grew "small by degrees and beautifully less," until it finally disappeared about night-fall—being wafted along by a gentle south-easterly breeze.

Nothing more was heard of the aëronauts for the next two days, and their friends were becoming naturally very anxious about them, when at last a telegram came from Bremen, dated the 21st, which ran as follows:—

"Nadar's balloon descended near Eystrup in Hanover. There were nine persons in it, of whom three were seriously, and two slightly injured."

Other telegrams quickly followed stating that M. Nadar had both legs dislocated; M. St. Felix had sustained severe fractures and contusions; and that Madame Nadar had also been severely injured.

It was stated that the voyagers would probably all have perished if Jules Godard (a celebrated aëronaut, who, with his brother Louis, accompanied Nadar), had not, at the risk of his life, climbed up the network, and cut a hole in the silk with a hatchet, so as to allow the gas to escape. By so doing, he stopped the furious course of the balloon, which was making truly gigantic bounds of from forty to fifty yards over the ground, with a violence that would soon have knocked the car to pieces!

A full and graphic, but inflated and sentimental

account of the voyage—which was one of real and thrilling interest—is given by one of the voyagers, M. Eugène Arnould, a reporter of the French newspaper *La Nation*. Had M. Arnould confined himself to a simple statement of facts, he would have greatly increased the interest and power of his description. However, we must take him as we find him, and as his account is the most complete—and correct in the main, although exaggerated in detail—we present it to the reader.

"At nine o'clock at night [the same night on which they started] we were at Erquelines; we passed over Malines, and towards midnight we were in Holland. We rose up very high, but it was necessary to come down to see where we were. Ignorant of that, our position was a critical one. Below, as far as we could see, were marshes, and in the distance we could hear the roar of the sea. We threw out ballast, and, mounting again, soon lost sight of the earth. What a night! Nobody slept, as you may suppose, for the idea of falling into the sea had nothing pleasant about it, and it was necessary to keep a look-out in order to effect, if necessary, a descent. My compass showed that we were going towards the east—that is to say, towards Germany. In the morning, after a frugal breakfast made in the clouds, we re-descended. An immense plain was beneath us; the villages appeared to us like children's toys—rivers seemed like little rivulets—it was magical. The sun shone spendidly over

all. Towards eight o'clock we arrived near a great lake; there I found out our bearings, and announced that we were at the end of Holland, near the sea.

"We passed I know not how much time in contemplating the enchanting scene around us; but at length we all felt the necessity of going downwards to see where we were. Presently the balloon came so near to the earth that we could readily distinguish the tall chimneys of a great many flaming furnaces. 'If we were to fall upon some of them,' said Montgolfier anxiously. These furnaces told us very clearly that we were in Belgium, and, besides, the Flemish songs that continually reached our ears left no doubt upon the point. Godard, Nadar, all of us, called out frequently to the people below, 'Where are we?' but we got no other answer than shouts of laughter. There were two bells in the car, and Yon and myself rang them as hard as we could, while Nadar roared through his speaking-trumpet. I had an opportunity of observing that the purity of the air in no degree attenuates the quantity of false notes lodged in the throats of certain individuals. Our aërial Charivari at length provoked a corresponding one on earth, and we could hear dogs barking, ducks quacking, men swearing, and women screaming. All this had a droll effect; but time went on, the wind blew hard, it was dark night, and our balloon drove on with prodigious rapidity, and we were not able to tell exactly where we were.

I could not see my compass, and we were not allowed to light a lucifer match under any pretext whatsoever. From the direction in which we had passed over Lille, we judged that we must be going towards the sea; Louis Godard fancied that he could see lighthouses. We descended again to within 150 yards of the earth. Beneath us we saw a flat marshy country of sinister aspect, and indicating plainly the neighbourhood of the coast. Every one listened with all his ears, and many fancied they heard the murmurs of the sea. The further we went on the more desert the country became: there was no light whatever, and it became more and more difficult to guess where we were going. 'I am entirely out of my reckoning,' exclaimed Louis Godard, 'and my opinion is that the only thing we have to do is to descend at once.' 'What! here in the marshes!' remonstrated all of us; 'and suppose we are driven into the sea?' The balloon went driving on still. 'We cannot descend here,' said Jules Godard; 'we are over water.' Two or three of us looked over the edge of the car, and affirmed that we were not over water, but trees. 'It is water,' Jules Godard persisted. Every one now looked out attentively; and, as the balloon descended a little, we saw plainly that there was no water, but without being able to say positively whether there were trees or not. At the moment when Jules Godard thought he saw water, Nadar exclaimed, 'I see a railway.' It turned out that

what Nadar took for a railway was a canal running towards the Scheldt, which we had passed over a few minutes before. Hurrah for balloons! They are the things to travel in; rivers, mountains, custom-houses,—all are passed without let or hindrance. But every medal has its reverse; and, if we were delighted at having safely got over the Scheldt, we by no means relished the prospect of going on to the Zuyder Zee. 'Shall we go down?' asked Louis Godard. There was a moment's pause. We consulted together. Suddenly I uttered a cry of joy; the position of the needle of my compass indicated that the balloon had made a half turn to the right, and was now going due east. The aspect of the stars confirmed this assertion. Forward! was now the cry. We threw out a little ballast, mounted higher, and started with renewed vigour with our backs turned to the depreciated Zuyder Zee. It was now three in the morning, and none of us had slept. Just as we began to try to sleep a little, my diabolical compass showed that the balloon was turning back again. 'Where are you going to take us to?' cried out Yon to the immense mass of canvas which was oscillating above our heads. Louis Godard again proposed to descend; but we said, 'No! forward! forward!' Two hours sped away without our being able to tell where we were. At five o'clock day broke, and broad daylight came on with marvellous rapidity. It is true that we were at a height of 980 mètres. Novel-writers and

others have so much abused descriptions of sunrise, on mountains and on the ocean, that I shall say little about this one, although it is not a common thing to see the horizon on fire below the clouds. The finest Venetian paintings could alone give an idea of the luxuriant tones of the heaven that we saw. Such dazzling magnificence led me to wonder that there is no revival of sun worship, since men must necessarily have some material representation of the divinity. It is true that the sun is not made in man's image! We now had beneath us an immense plain, the same, probably, that we had passed over in the night. There is nothing more pleasant at first sight, nor more monotonous in the long-run, than the sort of country which forms at least one-third of Holland. There are miniature woods the size of bouquets, fields admirably cultivated and divided into little patches like gardens, rivers with extraordinary windings, microscopic roads, coquettish-looking villages, so white and so clean that I think the Dutch housewives must scour the very roofs of their houses every morning. In the midst of every village there is a jewel of a church with a shining steeple. While riding along at a height of 700 mètres, we had beneath us a picture of Paul Potter's fifty leagues square. All at once the tableaux became animated. The people below had perceived the balloon. We heard cries expressive of astonishment, fright, and even of anger; but the feeling of fright seemed to predominate. We

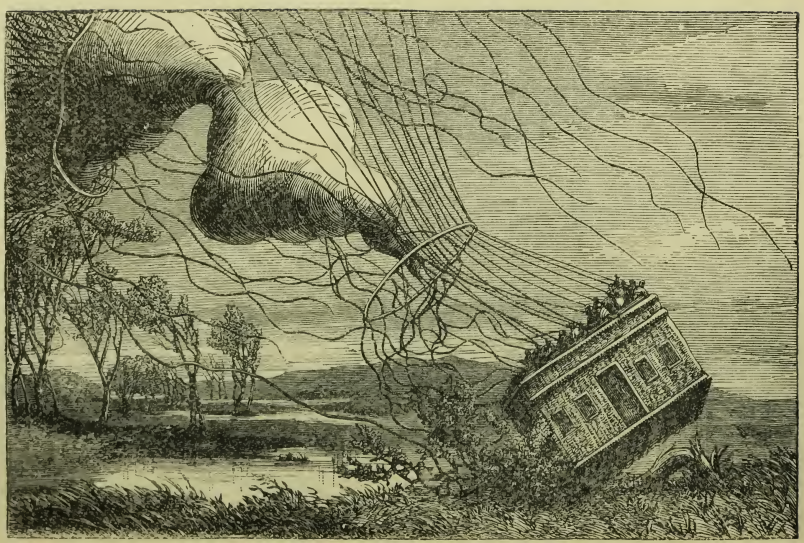
distinctly saw women in their chemises look hurriedly out of windows and then rush back again. We saw chubby boys looking at us, and blubbering as if they were mad. Some men, more determined than the rest, fired off guns at us. I saw several mammas pointing us out to stubborn babies, with an attitude which seemed to say that our balloon was Old Bogy. Old women raised their hands against us, and at their signal many ran away, making the sign of the cross. It is evident that in some of these villages we were taken to be the devil in person. On this point it is *apropos* to cite a letter communicated to me which has been addressed to the *Courrier de Hanovre.* I translate it textually :—

"'This morning, at about six o'clock, we saw passing over our heads, at a prodigious height, an immense round form, to which was suspended something which looked like a square house of a red colour. Some people pretend to have seen animated beings in this strange machine, and to have heard issuing from it superhuman cries. What think you, Mr. Editor? The whole country is in a state of alarm, and it will be long before our people recover their equanimity.'

"At seven A.M. we crossed over a lake near Yssel; the wind then again pushed us in a new direction, nearly at right angles with that which we were taking before. In less than a quarter of an hour the balloon got into Westphalia near Renheim;

then we crossed the great river Ems, the towns of Rheine and Ibbenbüren, and returned to Hanover a little above Osnabrück. We traversed, without deigning to take notice of them, a little chain of mountains, and by way, no doubt, of relaxation after so long a journey, went all round a lake which is called in German Dummersee. We then got into a great plain, through which runs a road. At this time the balloon became almost motionless. The reason of this was, that the heat of the sun had caused the gas to expand. The thermometer was then at 145° (about 59° Fahrenheit). Louis Godard was very uneasy about this dilation. After two or three oscillations, our aërial courser decided upon going off rapidly in an eastern direction, with about two degrees variation towards the north. This course would have taken us to Hamburg and the Baltic; but we were all so completely absorbed by the splendour of the tableau before us that we took little note of the change. Our hippogriff passed over Wagenfeld-Steyerberg, where there is a river which flows into the Weser. We came within sight of the great river and Nienburg, a considerable town on one of its banks. We saw a steamboat going down the river from the town. The view here was charming. A rustling of the silk of our balloon made us look upwards; the monster, under the influence of the sun, now very hot, was palpably swelling. As it would have been supremely ridiculous, after having made such a first-rate journey, to have treated the

inhabitants of Nienburg with the spectacle of seeing us blown up—to say nothing of the consequences of such a catastrophe to our own limbs—we resolved to come down. The remaining bags of ballast were got in order, the ropes and the anchors prepared, and Godard opened the safety-valve. 'The monster is disgorging!' exclaimed Thirion. And the balloon did vomit forth its gas with a tremendous noise, which may be compared to the snoring of some gigantic animal. While our companion made this observation, we were descending at the rate of two mètres to the second. 'To the ropes! to the ropes!—hold on well!' cried the brothers Godard, who seemed quite in their element, 'take care of the shock!' Every one climbed up to the ropes which attach the car to the circular handles underneath the balloon. Madame Nadar, whose *sang-froid* was truly magnificent, grasped two large ropes with her delicate hands. Nadar did the like, but at the same time put his arms round his wife so as to protect her body. I was on one side towards the middle of the sort of hurdle which serves as a balcony. I was on my knees and clinging to two ropes. Montgolfier, Thirion, and St. Felix were near me. The balloon descended so rapidly that it gave us the vertigo. The air, which we had left so calm above, became a violent wind as we neared the earth. 'We are going to throw down the anchors,' said Godard, 'hold tight!' Ah! the car struck the earth with tremendous violence. I cannot imagine how



Crossing the Country.

it was that my arms were not broken. After the first terrible shock the balloon went up again, but the safety-valve was opened—it again fell—and we suffered a second shock, if not more violent, at least more painful to us than the first. Up we went again; the balloon dragged its anchors. Several times we thought we should be thrown out. 'The anchors are broken,' exclaimed Godard. The balloon beat the ground with its head, like a kite when it falls down. It was horrible. On we went towards Nienburg, at the rate of ten leagues an hour. Three large trees were cut through by the car, as clean as if by a woodman's hatchet. One small anchor still remained to us. We threw it down, and it carried away the roof of a house. If the balloon had dragged us through the town we should, inevitably, have been cut to pieces. But fortunately it rose a little and then bumped against the ground again with as much violence as before. Every one of these shocks wrenched our limbs; to complete our misfortunes the rope of the safety-valve got loose from us, and the safety-valve shutting up we lost all hope of the balloon emptying itself. It went on by bounds of twenty-five, thirty, and forty mètres from the earth, and continued to fall upon its head. Everything that stood in the way of the car was dashed to pieces.

"Jules Godard then tried and accomplished an act of sublime heroism. He clambered up into the netting, the shocks of which were so terrible that

three times he fell on my head. At length he reached the cord of the valve, opened it, and the gas having a way of escape the monster ceased to rise but it still shot along in a horizontal line with prodigious rapidity. There were we squatting down upon the frail osier car. 'Take care!' we cried, when a tree was in the way. We turned from it, and the tree was broken; but the balloon was discharging its gas, and if the immense plain we were crossing had yet a few leagues, we were saved. But suddenly a forest appeared in the horizon; we must leap out at whatever risk, for the car would be dashed to pieces at the first collision with those trees. I got down into the car, and raising myself I know not how,—for I suffered from a wound in my knees, my trousers were torn,—I jumped, and made I know not how many revolutions, and fell upon my head. After a minute's dizziness I rose. The car was then far off. By the aid of a stick I dragged myself to the forest, and having gone a few steps I heard some groans. St. Felix was stretched on the soil frightfully disfigured; his body was one wound; he had an arm broken, the chest torn, and an ankle dislocated. The car had disappeared. After crossing a river I heard a cry. Nadar was stretched on the ground with a dislocated thigh; his wife had fallen into the river. Another companion was shattered. We occupied ourselves with St. Felix, and Nadar and his wife. In trying to assist the latter I was nearly drowned, for I fell into the water and sank.

They picked me up again, and I found the bath had done me good. By the assistance of the inhabitants the salvage was got together. Vehicles were brought; they placed us upon straw. My knees bled; my loins and head seemed to be like mince-meat; but I did not lose my presence of mind an instant, and for a second I felt humiliated at looking from the truss of straw at those clouds which in the night I had had under my feet. It was in this way we reached Rethem, in Hanover.

"In seventeen hours we had made nearly 250 leagues. Our *course infernale* had covered a space of three leagues. Now that it is over I have some shudderings. It does not signify! we have made a good journey, and I marvel to see with what indifference we may regard the most frightful death, for, besides the prospect of being dashed about on our way, we had that of gaining the sea; and how long should we have lived then? I am glad to have seen this—happier yet at having to narrate it to you. These Germans who surround us are brave people, and we have been as well cared for as the resources of the little spot will allow.

"*P.S.*—I have just reached Hanover with my companions, and re-open my letter to tell you so. The King has sent an aide-de-camp to us. Are we at the end of our reverses? At any rate, I am consoled to think they can no longer laugh at us in Paris. We have kept our promises, and more."

Making some allowance for the palpable exaggera-

tion of small details, this excitable Frenchman's description of the ascent is the best that we have seen, therefore we have given it in full.

The accounts given by other members of the party corroborate most of it, and correct a few of its errors. For instance, where M. Arnould represents the anchor as dragging off the *roof* of a house, another account states that it tore away one of the rafters; and while he tells us that large trees were "cut through by the car as clean as if by a woodman's hatchet," M. Godard says that they were knocked down or uprooted! But, upon the whole, after comparing the several narratives, we are of opinion that, with all his tendency to exaggeration and the use of inflated language, M. Arnould has found it impossible to convey by means of words an adequate conception of this, perhaps, the most wonderful and thrilling balloon voyage on record.

Many dangerous voyages of thrilling interest have been undertaken since this ascent of M. Nadar. We shall just give a brief account of two of these, which occurred at a comparatively recent date, to show the reader that men are not to be deterred by the misfortunes of predecessors from prosecuting inquiries and experiments in this field.

A *fête* was held some years ago in the park of Mr. North, Basford, near Nottingham. Amongst the amusements, it was arranged that Mr. Coxwell should make a balloon ascent. The balloon was almost new, but not of very large dimensions. After

it had been fully inflated, Mr. Coxwell tried it, and found there would be some difficulty in ascending in it, owing to its weight. At this juncture, a Mr. James Chambers, of Nottingham, who had previously made many ascents, stepped forward and offered to go in his stead, saying that he was lighter than Mr. Coxwell, and that he wished to make the ascent. After some conversation, it was agreed that Chambers should go up, but Mr. Coxwell told him not to attempt an ascent unless he felt quite confident that he could manage the balloon. Chambers replied that he had no fear about managing it, and accordingly he was allowed to make the ascent. The balloon rose steadily, and was carried somewhat rapidly in a north-easterly direction towards Nottingham. It proceeded as far as Arno Vale, when it was seen suddenly to collapse, while still at a considerable altitude, and then to fall quickly in an unshapely mass. Some young men who were near the spot where the balloon fell, hastened to render assistance. The balloon dropped into the car as it descended, completely covering it, and ultimately both fell in a field near Scout Lane, three miles from Nottingham. The car struck the ground and rebounded several feet, and then fell again, when it was seized and stopped by the young men, who had followed it. At the bottom of the car lay stretched the body of the unfortunate aëronaut. He was lifted out and found to be breathing, but quite insensible. He was conveyed to the nearest

dwelling, and means were adopted to restore animation, but without effect. Two medical gentlemen, named Robertson and Maltby, afterwards saw him, and it was discovered that his left thigh was fractured, and some of the ribs on his left side were broken, but they considered it very probable that the unfortunate man had died through suffocation, as a handkerchief, which had been found in his mouth, had probably been placed there by himself when he found that he was in danger of being stifled by the gas from the collapsing balloon.

On another occasion, still more recent, a perilous balloon voyage was accomplished by an aëronaut named Youens. He ascended from the Bellevue Gardens, near Huddersfield, in a balloon which was capable of containing 20,000 cubic feet of gas. Its height was 50 feet, and it expanded to 100 feet in circumference. Away floated the balloon in a westerly direction, oscillating for a considerable distance in a most extraordinary and unusual manner. Mr. Youens experienced a stronger breeze than he had anticipated, and, the current changing rapidly, his energy and knowledge as an aëronaut were very severely taxed. A fresh current drove him to the east for a time, but presently another gust unexpectedly sent him in the direction of Halifax, and thence towards Bradford, in a northerly course. After the lapse of twenty minutes the balloon and its occupant pierced the clouds. Mr. Youens then began to make observations for the

purpose of selecting a suitable site on which to descend; and in a few minutes concentrated his attention upon a field in which a *fête* was being held. The breeze, however, carried him some three miles further, and a second time Mr. Youens attempted to lower himself in a field adjoining some farm-houses at Denholme. Cautiously opening the escape-valve, he continued the journey downwards and threw out the grapnels. Impetuous blasts of wind increased the difficulty of bringing the balloon to anchor. A strong wind prevailing, it became unmanageable, and drifted over fields and stone walls with amazing velocity. The flukes of the grapnels penetrated the ground and uprooted the earth as they followed in the wake of the balloon, while the aërial chariot dashed onwards, making, in its career, wide gaps in several stone walls. Mr. Youens, preparing to encounter the worst fate, wrapped the end of the cord which opens the escape-valve round one of his wrists, and, burying himself in the car, permitted the balloon to proceed until the breeze subsided, when, after the car had been thrice capsized, and every article which it contained thrown out, Mr. Youens, who received no injuries, anchored, and completed a voyage of many miles, which occupied half-an-hour in its accomplishment.

CHAPTER IX

WAR BALLOONS

AS the French were the first to teach mankind the art of navigating the air by means of balloons, so they were the first to set the example of applying them to the art of war.

It may not be generally known, perhaps, that balloons have actually been used in war. They were first introduced to this new field of action at Valenciennes in 1793, and the result of the experiment was a failure; not, however, owing to the fault of man, but to the unpropitious nature of the winds. The garrison, being hard pressed by the English and their allies, attached a letter, addressed to the National Assembly, to a small balloon, or parachute, and committed it to a breeze which blew in the direction of Paris. Towards evening the wind changed, and the faithless messenger fell into the enemy's camp!

About the same time the subject of war-balloons was brought before the Committee of Public Safety, who commissioned a young captain of Engineers,

named Coutelle, to make experiments, and report on the matter. He made a balloon twenty-seven feet in diameter, with a car to hold two persons, which, when filled with hydrogen gas, was capable of lifting about a quarter of a ton, and cost a little above £80. It was not intended that this balloon should go free. It was to be held down by two guy-ropes, each between four and five hundred yards in length, by which, when at the full length of its tether, the balloon was to be hauled about in any direction, pulled down, or allowed to rise in obedience to the wishes of the aëronaut, who was to communicate his orders by means of a system of signals. Reports of what he might be thus enabled to discover of the enemy's position were to be written on slips of paper, put into small sandbags, and tossed overboard. Small coloured flags were attached to each bag, so that it might be easily observed in its descent.

After several satisfactory ascents to the height of above 500 feet had taken place—the balloon being held easily by ten men, five to each guy-rope—an order was given, in April 1794, for the formation of a company of military aëronauts—styled *aérostiers*, to which Coutelle was appointed captain-commandant. His company consisted of one lieutenant, one sergeant-major, one sergeant, two corporals, and twenty privates, who wore a dark blue uniform, with black velvet facings, and were armed with pistols and swords.

This new and peculiar company of aérostiers was

very soon sent to join the army at Maubeuge, and was regarded with some ridicule and contempt by the rest of the army. Coutelle, however, took an effectual method of commanding respect. He begged that he and his men might be allowed to take part in a projected *sortie*. They were permitted, and went; an officer and private were wounded, and the corps behaved with such gallantry that it was from that time treated with becoming respect.

Ascents were made daily in the balloon for reconnoitring purposes, and the Austrians fired at their audacious and inquisitive enemy both with muskets and cannon, but without effect.

After a time the balloon was ordered to take the road, and join that part of the army which was marching on Charleroi. Its march through the country in leading-strings was curious to spectators and harassing to the aérostiers. The car, with all its appurtenances, was placed on a cart, over which the balloon was allowed to float at a height sufficient to admit of the passage of cavalry under it. Twenty men, marching in single file, held it down by twenty stays; but they had a sad time of it, for their charge was headstrong and restive, jerking and tugging at them continually, not only with its own inherent power of ascension, but with the irregular impetus derived from gusts and squalls of wind, which caused it to make sudden and violent charges against trees, houses, or whatever chanced to come in its way, and

sometimes to beat its blunt forehead wildly on the ground as if it had been a monster in despair!

It reached Charleroi, however, on the 22d of June, after a journey of three days, and took part in the battle of Fleurus on the 26th. A high wind rendered it necessary, on the day of battle, to fasten its guy-ropes to thirty horses—fifteen to each rope—and, thus secured, it remained in the air eight hours, passing from place to place, and making observations. Its services were so highly appreciated by the generals on that occasion that a second balloon was made and sent to the field of action. The first one, which was named *l'Entreprenant,* met with accidents which rendered it necessary that it should be sent to Maubeuge for repair; but it afterwards rejoined the army and took part in the battle of Aldenhoven, at the capture of Bonn, and at the operations before Ehrenbreitstein, in all of which it escaped without a wound, although frequently exposed to a furious fire of musketry and shells from the exasperated Austrians.

Nevertheless, its natural enemy, the wind, did not allow it to escape scatheless, as Coutelle shows in one of his letters. He writes thus:—

"I received orders to make a reconnaissance of Mayence. I accordingly posted myself between our lines and the town, at about half cannon-shot distance. The wind was very high, so, to counteract its effects as far as lay in my power, I ascended alone, with two hundred pounds additional buoy-

ancy. I was at a height of five hundred mètres when three successive gusts dashed me to the ground with such violence that several portions of the car were smashed to bits. Each time the balloon darted up again with so much force that sixty-four men—thirty-two at each guy-rope—were dragged to some distance. Had the guys been made fast to grapnels, as had been suggested to me, they must infallibly have given way."

Notwithstanding this rough treatment, the aërial warrior managed, during a lull in the wind, to count the number of the enemy's guns.

But the successes of these war-balloons were sadly intermingled with reverses of fortune and harassing difficulties. The aëronauts had, indeed, won the respect and admiration of the army, but this did not compensate for the terribly fatiguing work of holding on, with scarcely a moment's intermission, to the ropes of the intractable monsters during long and frequent marches. The second balloon at length succeeded in breaking loose, and was so much damaged as to become unserviceable, and the first one was afterwards found riddled with balls—destroyed, it was supposed, by its own men, who had become tired of the hardships to which they were continually subjected. The balloon was repaired, but was taken prisoner at Wurtzburg in September 1796, after a short but brilliant, and, it is said, useful career.

After this the war-ballooning fell into disrepute. Some attempts have been made in modern times to revive it, but these are not worth mentioning.

CHAPTER X

AËRIAL LOCOMOTIVES, ETC.

HAVING treated of the balloon in all its different aspects, it is both just and appropriate to conclude with an account of the theory and construction of that curious machine which is, according to some enthusiastic aëronauts, to supplant the balloon altogether, and enable us to accomplish that which has been one of the great aims and desires of mankind from the earliest ages, namely, the directing of our flight, or steering a course, not only through, but, if need were, in opposition to the winds.

M. Nadar being, perhaps, the most zealous advocate of this machine, we draw our information chiefly from his writings. Of course the reader will understand that we do not support the views which we are about to set forth; neither, however, do we treat them lightly, because we have lived long enough to see proposals which, not many years ago, would have been deemed worthy of the most visionary of lunatics, carried out to a successful issue and reduced to sober facts.

When we hear of a *flying machine* which is to rise from the earth at the bidding of man, and, like the fabulous creations in the *Arabian Nights' Entertainment*, dart through the air with passengers and luggage bound for definite localities, turning hither and thither, or alighting on the earth according to the will of a steersman—we confess to a feeling which is apt to wrinkle our visage with the smile of incredulity; but we sternly rebuke the smile, for we know that similar smiles wreathed the faces of exceedingly wise people when, in former days, it was proposed to drive ships and coaches by steam, and hold instantaneous converse with our friends across the Atlantic by means of electricity!

Let us therefore gravely consider the aërial locomotive.

M. Nadar, as the reader already knows, scouts the idea of steering balloons.

In reference to this he states with truth that "a balloon which presents to the action of the atmosphere a volume of from 22,000 to 42,000 feet of a gas from ten to fifteen times lighter than air, is, by its very nature, smitten with incapacity to struggle against the slightest current, no matter what may be the resisting motive force which may be imparted to it. Both by its constitution, and by the medium which drives it hither and thither at the pleasure of the winds, it can never become a vessel. It is a buoy, and remains a buoy."

Discarding, therefore, with contempt, the balloon

as an aërial locomotive, he announces his belief that it is the *screw* which is destined to drive us, or clamber with us, into the blue vault above, and convey us from place to place. And here it is right to assure the reader that the theoretical power of the screw to accomplish the end in view is not a disputable question. It has been practically proved by models, and the only point that remains to be settled is the possibility of applying the power to machines large enough to carry human beings with a sufficient degree of safety to warrant risking the attempt.

M. Nadar sets out with a statement which he deems self-evident, namely, that "in order to contend against the air, we must be specifically heavier than the air"—a truth which was also, we are told, announced by the first Napoleon in the epigrammatic sentence, "There can be no progress without resistance." From this the Frenchman proceeds to prove that, in order to command the air, it is necesary to support one's-self upon it, instead of being at its mercy; that we can only rest upon that which resists, and that the air itself furnishes us amply with the needful resistance—it being "the same atmosphere which overturns walls, tears up by the root trees a century old, and enables ships to ascend impetuous currents." Glowing with the ardour of a man whose faith is refreshingly great, he tells us that the time has at last come when the atmosphere must yield to man. "It is for man," he says, "to restrain and subdue this insolent and abnormal

rebellion, which has for so many years laughed at our vain efforts. We are in turn about to make it serve us as a slave, just as the water on which we launch the ship, as the solid earth on which we press the wheel!"

There is a toy called the *spiralifer*, which is common enough in towns, and which is, doubtless, known to almost every one. It consists of four flat fans attached to a spindle somewhat after the manner of the arms of a windmill. It is placed in a hollow tube and made to spin violently by pulling a string wound round the spindle. The result is that the spiralifer leaps out of the hollow tube and ascends powerfully as long as the violent spinning motion continues. If properly constructed, this toy acts with great force and certainty, and if the spinning motion could only be kept up, by any means, the ascent would be continued. The principal here involved is precisely the same with that which causes a wind-mill to turn, a screw-propellor to drive a ship, and a cork-screw to enter a cork. It is pressure against a resisting medium. Air is the resisting medium in the case of the mill; water and cork respectively in the other cases. The only difference between the wind-mill and the spiralifer is, that the first is moved by the air pressing against it, the other by itself, in its rotatory action, pressing against the air. If you turn a bottle upside down, and, while in that position, send a cork-screw up into the cork, you set in motion the same force

which is applied in the spiralifer. As the screw screws itself up into the cork, so the spiralifer screws itself up into the air. Of course the screw remains sticking there when the motive power ceases, because of the density of the medium through which it moves, while the spiralifer, when at rest, sinks, because of the fluidity of the air; but the principle of motion in each is the same. The screw-propellor of a ship is just a spiralifer placed horizontally, acting on water instead of air, and having a vessel placed in front of it.

Now, M. Nadar's aërial locomotive is a huge spiralifer, made strong enough to carry up a steam-engine which shall keep it perpetually spinning, and, therefore, perpetually ascending. Perhaps we should have said that his locomotive is a huge machine to which several spiralifers are attached, so that while one set raises or (by reversing the engine) depresses it, other sets drive it sideways. The theory is perfect, and the practice has been successfully attempted in models. MM. Ponton d'Amécourt and De la Laudelle, we are told—"the one a man of the world, and the other a man of letters"—engaged the services of two skilled mechanics, MM. Joseph of Arras and J. Richard, who constructed models of machines which ascended the atmosphere, carrying their motive power (springs) along with them.

Besides horizontal screws, it is proposed to furnish additional guiding power to the locomotive

by means of inclined planes. These, by being arranged in various positions, while the machine is in motion, would act on the air, as do the wings of a bird, and give it direction.

No doubt, despite the simplicity of all this, difficulties will present themselves to most minds, some of which may perhaps bulk very large in the minds of mechanicians—such as the power of materials to withstand the violence of the forces to which they are to be applied, etc. We do not know; however, no difficulties seem to have afflicted M. Nadar, who thus grandly waives them all aside, and revels in the contemplation of the triumphant flights that lie before him in the future:—

"It will be understood," he writes, "that it belongs not to us to determine at present either the mechanism or the necessary manœuvres. Neither shall we attempt to fix even approximately the future velocity of the aërial locomotive. Let us rather attempt to calculate the probable velocity of a locomotive gliding through the air, without the possibility of running off the rails, without any oscillation, without the least obstacle. Let us fancy such locomotive encountering on its way, in the midst, one of those atmospheric currents which travel at the rate of forty leagues an hour, and following that current; add together these formidable data, and your imagination will recoil in adding still further to these giddy velocities, that of a machine falling through an angle of descent of

from 12,000 to 15,000 feet in a series of gigantic zigzags, and making the tour of the globe in a succession of fantastic leaps."

Truly M. Nadar seems to us to be right! There are few men or women, we suspect, who would not recoil from such "fantastic leaps," and unless the prospect of a more sedate style of travelling be held out, it is not probable that aërial locomotives will receive much patronage from the general public.

Lord Carlingford, who mistook the sentiments of M. Nadar in regard to the aërial locomotive, claimed for himself, in 1863, the honour of having previously invented and successfully launched an aërial chariot, weighing seventeen stone, which rose on the air without any assistance but that of the wind, and, having arrived at a horizontal position on the air, it remained stationary there until pulled down.

M. Nadar, at the conclusion of a courteous letter in reply to this claim, gives his intentions and opinions on the subject pretty clearly as follows :—

"In fine, and that there may be no possible mistake on the part of any one regarding what I am attempting, I desire to find the necessary resources for the constitution of a society, which shall be the centre of all hitherto isolated and therefore lost attempts to solve a question so profound, so vast, so complex that it does not seem to belong to a single individual to achieve it. I have my system, which I believe to be good, since it is mine; but I shall aid with all the strength of my will, and with all the energy of

my perseverance, every system which shall be proved to be better than mine. The question to me is not at all who may have determined the great problem; it is that the solution may be found at last. The fruit is ripe; I long to see it plucked, no matter by whom; and this is the sole cause of the agitation which I have endeavoured to call forth, and which I am now pursuing."

A man who takes up a subject with such hearty enthusiasm, and in such a liberal spirit, is, we hold, entitled to the utmost respect. As we have, however, done our best to lay his case before the public, we feel entitled to express with all humility some of the doubts which have been suggested to our own mind while meditating on the subject.

No doubt the theory propounded is correct, and, as carried into practice with models, the aërial locomotive has been a great success. No doubt also it is pleasant to contemplate the possibility of traversing space like a bird, a meteor, or a comet, and the absolute impossibilty of "getting off the rails"; but what, we would ask, would be the result of a hitch —ever so small—in the working of the steam-engine or of the spring motor?

If a railway engine breaks down, there are all sorts of chances of escape open to the traveller. The engine may not quit the rails, or it may bound off alone, snap the coupling chains and leave the carriages to run until they come to a gradual standstill; or, the concussion may be so modified that no

serious injury may result; or, should it come to the worst, the traveller may be among the fortunate number who make "miraculous escapes." But if a crank of an aërial machine should snap while it is careering through space, or even a screw get loose and cause a momentary stoppage of the motor, it is abundantly evident that escape from total and swift destruction would be "miraculous" indeed, for the whole affair would come to the ground like a thunderbolt, and "leave not a wrack behind!"

Probably it might be answered in reply that a parachute attached to the machine, or the inclined planes acting as a parachute, would moderate the descent. Well, there may be *something* in that; nevertheless, parachutes have not yet proved themselves to be very trustworthy,—and we are constrained to reiterate the fact, that while an accident causing the break-down of the motive power of a steamboat or a railway carriage does not necessarily involve fatal consequences, an accident which should stop the motive power in an aërial locomotive would *almost* to a certainty, result in a grand smash, which would involve machine and passengers in one inconceivable whirl of chaotic destruction.

Whether this machine shall ever be successfully completed or not, it is evident that it still engages the earnest attention of men, as we gather from the following paragraph recently published in the *San Francisco Bulletin*:—

"At a meeting of the Aërial Navigation Company,

held on Friday, July 24, 1869, in San Francisco, it was voted to raise the necessary funds to construct an improved avitor of large size. The opinion of the engineers of the company was unanimous as to success so far, and the feasibility and success of the projected flying-ship. It will be about 150 feet in length, 20 to 40 feet diameter of the gasometer, with propelling blades on each side of the centre, describing a radius of about 16 feet. The propellers are shaped like a steamship's, with two blades, each very light. They will be driven by a steam-engine of five-horse power, weighing, with boiler connections and water, 430 lbs. The planes on each side for floating the machine will be about twenty feet wide at the centre of the machine, and made in sections, so that they can be depressed or elevated at pleasure with the rudder or tail. The gasometer will be made in sections, so that in the event of accident to one section, the remainder will be sufficient for all practical purposes; indeed, it is claimed that the ship can fly through the air with such speed that the sustaining power of the planes alone will be sufficient to maintain the avitor in mid-air. The gasometer will be made, probably, of thin muslin or silk, saturated with gutta-percha. It is to carry four persons, and will be ready for trial in sixty or ninety days. The result of this experiment will be looked for with great interest all over the country."

The Americans, with that vigour of conception

and promptitude in action for which they are celebrated, have done a good deal in the cause of aërostation; but, as their doings and experiences have been in many respects similar to those men whose voyages have been already recounted or touched upon, it would involve too much repetition to detail them here. Some of their attempts, however, have outshone those of the men of the eastern hemisphere. For instance, Mr. J. Wise, a noted aëronaut, has several times exploded his balloons while in the air, to show that the fragments with network form a sort of parachute which moderates the descent. He also, with Mr. La Mountain and others, accomplished in 1859 the longest flight on record, namely, 1150 miles in less than twenty hours; and the latter gentleman did 300 miles in four hours in the same year. Another American, Mr. Lowe, made an enormous balloon, with which he resolved to cross the Atlantic in about 48 hours. We await the accomplishment of this feat with much solicitude!

In conclusion, we may say that the subject of aërostation is still in its infancy, and that we have still to learn how to conduct ourselves properly when—Up in the Clouds..

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